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ORIGINAL ARTICLES

ADVANTAGES OF LINGUAL APPLIANCES, WHEN INDICATED AND THE IDEAL AGE FOR THEIR APPLICATION IN DISTO-CLUSION CASES*

BY DR. P. T. MEANEY, PORTLAND, OREGON

THE child's bones grow in proportion to the amount of bone building food taken into the body. These bones are shaped by association with other bones and by muscle attachment and muscle action. The normal use of the muscle will aid in normally developing the bone. Abnormally used muscles will tend toward abnormal bone growth.

Considering the above facts, judgment must be used when selecting an appliance to counteract and stimulate bone development, to accommodate teeth and to stimulate and develop growth and action of muscles of the face and chest to guide and retain teeth in their respective positions.

The normal human denture in its completeness includes not only the jaws, dental arches, alveolar processes and especially the teeth and peri-dental membranes; which to us are of prime importance since on them chiefly our operations are performed, but also the muscles of lips, cheeks, tongue and mouth, the nasal passages, palate and throat, as these assist the teeth in performing their function. They are also powerful factors in establishing and maintaining either harmony or inharmony in the development and arrangement of the teeth, and this just in proportion as they are singly or collectively normal or abnormal in their own development and function.

Many cases of slightly underdeveloped arches have been enlarged by use, by systematic mastication. I cannot refrain from mentioning in this con-

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nection an instance of a Washington dentist who encourages his boys to chew inner tubes of automobile tires as a means of stimulation.

If the last mentioned facts will result in larger bones to accommodate teeth, then a general stimulation through an orthodontic appliance allowing the teeth as a group and singly to move freely and occupy new positions and retain these positions, is as near an ideal as we would hope to reach.

The applying of stimulation through the use of a lingual appliance in many cases is sufficient to encourage new growth. It has many features that may make it an ideal arch for stimulating bone growth: simplicity, allowing the teeth to move in several directions without interference, encourages the natural forces of occlusion, less banding, making prophylaxis much easier for the patient. The fact that teeth regulated by the use of the lingual appliance partially allows them to seek new positions voluntarily will shorten the necessity for retention and there will be less danger of recurrence after retainers are removed.

The ideal ages for Class II, Division I cases are as follows: from five and one-half years to thirteen years. The eruption of the first permanent molar is a stimulation for anterior movement of the lower teeth and the development of the mandible. I have a number of cases of this Class and Division at the ages of six years, where the lingual appliance was placed on the maxillary arch only, and by obtaining expansion of the maxillary arch, I unlocked the malrelation of the cusps and by stimulation, through occlusion, the mandibular teeth moved forward to neutral occlusion.

Expansion of mandibular arch will be necessary later but you can eliminate the use of intermaxillary rubbers and retention is much easier, because the forward movement is voluntary. During premolar eruption, we have stimulation that is worthy of consideration, but this stimulation may be offset by the abnormal resorption or shedding of the deciduous molars, thereby losing the benefit of eruption.

Eruption of the second permanent molars and canines will aid us to a very marked degree, in conjunction with the lingual appliance, but at this age, as mentioned above, the long disuse of the muscles requires longer retention, with less assurance of permanent results.

DISCUSSION

Dr. James D. McCoy.—I should like to refer to a point that was discussed at the last meeting of the local Orthodontia Society, namely the question of the best age for orthodontic treatment. At that meeting the discussion revolved about the question of those cases where the deciduous teeth only were present. I would like to ask this definite question: Suppose a child of your own between four and five years of age had all of the deciduous teeth present and in function, with no marked malocclusion present, but the spacing in the incisor region was not sufficient to allow for the complete eruption of the permanent incisors, would you put appliances on and develop the arches, or would you do a little watchful waiting? Those who would put appliances on please stand up.

(Four favored the immediate use of appliances, while about twenty voted to defer treatment somewhat.)

Dr. Robert Dunn.—There are extreme conditions.

Dr. McCoy.—We are talking about average cases.

Dr. Dunn.—We have children in my family, ranging from three to twenty-two years of age and have tried treatment in their cases at all stages. It is my opinion that it is best to wait until patients are six or seven years of age.

Dr. A. H. Suggett, San Francisco.—Dr. McCoy should have worded the question differently. The test of our best judgment is not what we would do in our own family. We may not do things as thoroughly for members of our own family as we would for an outside patient.

I voted that I would put on an appliance in this case because I have not developed a technic of teaching muscular development.

Several years ago I saw models of the teeth of two little boys taken at about three years of age which showed the incisors badly crowded and overlapping. The father, a dentist, took the children in hand with the view of securing muscular development. Although his knowledge of teaching development only included mastication, he succeeded in developing the arches so that at the age of five the teeth were perfectly regular.

It is very important to develop a technic by which we are able to get our message over to the patient. In the meantime I am using appliances until I have developed a more perfect technic.

Dr. John R. McCoy, Los Angeles.—I do not agree with Dr. Suggett that it is necessary to put on appliances in order to develop these arches, but I would favor the other means mentioned, such as chewing hard foods, etc. So long as the child's teeth are functioning I think it is best not to place appliances. In most cases where an appliance is adjusted at four years of age you will doubtless have to put them on for secondary treatment later, and I think you will all agree that one period of treatment is enough for any child.

Dr. Robert Dunn.—I would not have you believe I arrived at my conclusions merely from the treatment of my own children. I have had a few other patients. The essayist spoke about the lingual appliance in Division I Class II cases. Those cases he speaks of are probably due to certain causative factors. There are many other cases of Division I, Class II in the treatment of which we know the lingual arch is absolutely contraindicated.

Dr. A. H. Ketcham, Denver, Colo.—I wish to compliment Doctor Meaney on his excellent paper. It is our duty to be informed in regard to foods for young children. A pamphlet published by the Department of Agriculture at Washington entitled "Foods for Young Children" is excellent. We now have this fad of vitamines. It contains much truth, but it is being overdone by firms having "canned" vitamines to sell. If we learn more about vitamines we will do a greater amount of good in imparting to the mothers of our patients knowledge of what foods to select and how to prepare them to secure the needed vitamines. Our knowledge should contain the last word in regard to foods and in regard to proper exercise of the muscles of the tongue, lips, and cheeks; for many of our little patients are not only lacking in development of the dental arches, which are often under the influence of abnormal muscle action; but their whole bodies are underdeveloped and undernourished and proper foods and proper exercise are needed.

Dr. Robert Dunn.—I wish I had a practice where my clients would take some of my advice and do what I should like to have them do. My experience is most of them work along the lines of least resistance, parents and children alike.

Dr. Meaney, (closing discussion).—I came down here to get ideas from you gentlemen. The tying up of little children's teeth all in a group does not appeal to me. I only wish that every one of you men would tear my paper to pieces. I do not care whether you agree with me or not. I wish you would disagree with me and thus I would probably learn something from you. These gentlemen who have discussed the paper have brought out facts which confront all of us. The question as to what you would do with your own family has nothing especially to do with your procedure for the other family's child. You know how to prescribe for your own family and help them follow your directions. I voted against the use of appliances at a very early age, because I will attempt in my own family to try and stimulate growth without appliances. I have a boy with an undeveloped arch. He is just past four years of

age. I am using no appliances, and am getting development by stimulation. I will not use appliances in his case unless I am forced to do so. However, Bill Jones may do for his boy what I will not do for mine. Depending on other people to do what you want them to do is the hardest thing we have to contend with in orthodontia. Too often we have no control of our patients. We have to depend on our patient for cooperation. If we can get results through stimulation, the simplest stimulation, without tying the teeth up in a manner precluding prophylaxis, that is the best thing. In certain cases, so long as the patient breathes through the mouth your work is a failure. It is a hard thing to handle some of the problems that present themselves, but we will not sit quietly and continue our old routine, as we have done before. I have cases of Class II Division I which have not responded as I would have them. They have been retained two or three years and there is no normal function. If there is anything we can suggest toward taking care of these cases it is to the children's advantage, and to our advantage. Speaking of the development at the age of four years, I am inclined to think we are not quite sure whether the development is normal at four or whether it will be so at six. How do you know but at the age of six the development will be correct? How do you know the child will not be normal at six in this regard? In that event if treatment is undertaken at the earlier period you are doing something that is abnormal for that case. The permanent molar coming in at the later period will assist in getting the stimulation and the normal development. As you go beyond this the wrong muscular action, etc., will make treatment more difficult. You are to use your own judgment in each case, depending on the immediate circumstances.

SOME ADVANTAGEOUS METHODS OF APPLYING THE LINGUAL ARCH*

By W. J. Bell, D.D.S., Los Angeles, Calif.

IT is the writer's opinion that the orthodontist is working under greater difficulties with less scientific appliances at his command than is the general practitioner and he relies upon his individual skill and judgment to correctly restore the teeth to their normal occlusion and function.

There is no perfect appliance that can fit all cases and it is doubtful if there ever will be. It is possible than an appliance will be designed for each different classification, division and subdivision.

The public is demanding more of the orthodontist than it did a few years ago and for that reason this specialized profession is alert to every new suggestion that can aid them to accomplish the best results possible.

Perhaps the appliance that is attracting the most attention at the present time is the lingual arch. While not perfect, it has a good many points in its favor.

As every orthodontist knows, the majority of cases presented for treatment, require expansion of the dental arch, and for this reason it would seem that the lingual appliance is particularly advantageous for that purpose, for as a rule, it requires fewer bands than does the unsightly labial appliance.

Another object is to do away with the ligature wires as much as possible, for most of this wire, as now on the market, is made of base metals which

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easily corrode, darken the teeth and produce an unhealthy condition of the soft tissues.

In applying the lingual appliance, the first step to be considered is a removable attachment to the anchor band on the first molar.

The round and half round tube and pin and other devices have and are still serving a good purpose, yet, as a locking device, these have their disadvantages and limitations.

A device whereby the arch can be raised or lowered from the teeth without being detached from the anchor band was devised as a means for more thoroughly and easily adjusting the wire in contact with the teeth.

This attachment is of swivel construction and is so arranged that when the anterior portion is partially removed from the teeth, a slight inward pressure on the arch detaches it from the molar band and it can then be removed for any needed changes that cannot be adjusted in the mouth.

In the model exhibited the premolars are shown banded. Two small wire hooks are soldered on the lingual side in such a position as not to interfere with the lingual wire when in place. A small lug is soldered on the lingual appliance adjacent to the center of the premolar.

Spring-platinum wire about twenty-four gauge or finer is then wound two or three times around the arch, then passed around the lung and wound in the opposite direction two or three times. The ends are cut off the proper length and bent slightly outward.

This makes a double spiral spring around the lingual arch leaving enough of the two ends of these coil springs to be pressed under the wire hooks that are attached to the band.

The object in this construction might be said to be twofold; first, widening of the dental arch; and second, a circular and inward pull on the crown of the tooth.

According to the law of leverages, this would move the root of the tooth outward as the root becomes the load; the appliance, the fulcrum; and the spring, the power.

The pull is not rigid, but very light, flexible and continuous.

This method also has the advantage in that the ligature wires and tying devices are unnecessary to hold the appliance in place and there is no renewal of extra parts at each sitting, which most other appliances require.

The particular advantage of this method of applying the lingual appliance is the fact that it keeps the outer cusps of the teeth in contact and tends to produce and preserve a better occlusion which is not the case when the plain lingual appliance is used.

While I have shown the bands attached to the premolars, they can be advantageously applied to any other tooth.

Another design is by means of the little more than half round tube attached to the molar band. A sleeve nut and sleeve and lingual wire constitute the appliance as shown by the model on exhibit.

In speaking of the law of the lever, we, as orthodontists, at once picture something bulky or something used only by mechanics.

While we are not interested in anything of such magnitude as was the ancient philosopher who said, "Give me a lever long enough and I will raise the earth," we are interested in its principle as scientifically applied in orthodontia and whether we realize it or not, our efforts without it are useless.

Our Creator applied its principles liberally to our bodies. The eyes, jaws, arms and legs, in fact, the whole bony structure would be useless without it and our bodies would be an inert mass.

Not unmindful of the fact that the muscular action plays a prominent part, it is realized that the mechanical movement is the guide for Nature, the real builder, and the importance of the facial muscles is not underestimated nor do we lose sight of the narrowing tendency due to the muscular action on the bony structure at its origin and insertion.

When any pressure is put on the crown of a tooth without a balancing pull or counter force in the opposite direction, the crown becomes the power; the cervical portion, the fulcrum and the root, the load; and it follows that the apical portion of the root movement would be in the opposite direction from the pressure applied to the crown.

If this pressure is applied to a temporary tooth, which has little root absorption, it can readily be understood what the action will be, particularly on the premolars which at this early stage have little root formation.

Group movement is due for serious consideration from the orthodontist. By group movement is meant where two or more teeth are correctly in position. A fixed appliance should be applied to preserve an individual group movement. The object is not to disturb their anatomical relation.

When the direction in which a tooth is to be moved has been determined, a gentle, steady pressure should be maintained until the desired position is secured and at no time beyond that position as this causes unnecessary bone absorption and unstability of the tooth.

Can this be accomplished in all cases with the present appliances at our command?

Such *might* be the case if the molar anchorage was sufficient to balance the pressure on all the other teeth which are to be moved. The need of the orthodontist is an appliance which is flexible with a steady, even, light, and direct pressure in the proper direction, and to attain this the combined efforts of the orthodontists will accomplish results nearer perfection.

DISCUSSION

Dr. A. A. Solley, San Francisco.—I think Dr. Bell has covered the points of his appliance pretty well. I like some of the points he brought out and some I do not like. I think the principal points of his appliance have been missed by some of the men. I think there are two forces exerted by appliances. The first expansion, as gained from the base wire. We know sometimes when we try to get expansion from the base wire, we get tipping of the teeth. A good bit of the tipping is due to the fact we are in too much of a hurry: there is too much mechanical work and not enough head work. I like to get away from as much appliance as possible. I think the lingual appliance good, provided we do not try to have it too complex. In this appliance I would be afraid of gingival irritation, and the chance of the collection of food on the inside is an objection.

I do not like the idea of putting pressure on the appliance after it is placed in the mouth. No matter how slight the pressure it, you do not know how to guide it. We cannot measure it. We should apply the force outside where we can measure it as closely as possible.

In using the lingual wire with the auxiliary springs, as many of us do, I do not know how much trouble you have, but I have considerable tipping. Maybe I use too much force. The little wire spring in connection with his band would be rather a good point as a supplemental anchorage. His lock, I like very much. In the lock I am using, i.e. the half round wire, I have had considerable trouble with crystallization in the soldered joint, in the breaking of the half round wire. Probably Dr. Bell's locking device will overcome that point. The idea of no solder on the springs is excellent.

Dr. P. T. Meaney, Portland, Oregon.—I would like to discuss this appliance, but I do not understand the mechanics enough to enter into it as I wish I could. I would like to have seen more of it. If these molar attachments are practical, I think the Doctor should be commended for his effort to get something like this established. I feel a bit lost as to the mechanics of it however.

Dr. James D. McCoy, (acting as Chairman.)—I am going to put on two clinics here, and I will ask Dr. Bell to show his clinic again so anyone not understanding it may have the opportunity of having it demonstrated a second time.

Dr. W. J. Bell.—The object of the auxiliary spring wire is a balance force exerted on the root to move it in the same direction as the outward pressure of the lingual base wire.

Dr. Meaney speaks of the mechanics of the appliance. It is a fact that if we put pressure on the crown of a tooth without a balancing force in the opposite direction, as stated in my paper, the apical portion of the root (whether the pressure be light or heavy) is bound to move in the opposite direction from the force applied to the crown.

Dr. Robert Dunn.—Are you sure the apex moves?

Dr. Bell.—Take a lever like that, (demonstrating) that represents the crown and this the socket of the tooth and this the wire, that is the law of the lever.

Dr. Dunn.—That does not apply in the movement of a tooth.

Dr. Bell.—It applies to anything where the principle of a lever is used.

Dr. James D. McCoy.—Dr. Bell, I think you are mistaken.

Dr. Bell.—If pressure is put here, (indicating) you are moving the crown in the opposite direction, given the apex. The greatest pressure is here, (indicating) and so the greatest movement will be at the gingival border. There is an inward movement, if no counterbalancing force is applied.

Dr. James McCoy.—I think you have made a statement you cannot prove.

Dr. Bell.—Maybe I have but I do not think so.

Dr. James McCoy.—You are discussing the matter from the standpoint of cold mechanics and we are discussing it from the standpoint of mechanics vs. physiologic factors and changes.

Dr. Bell.—No part of the body is immune to the law of the lever. The pressure on the apical portion of the root is in proportion to its length, as compared to the distance of the force applied to the crown is to the gingival margin which forms the fulcrum.

Dr. Suggett.—In two patients with narrow mouths I have gotten a large amount of expansion without anything but a lingual wire and the roots have moved out through growth.

Dr. Bell.—You cannot expect a growth in the opposite direction from the root movement without a counter or balancing force. I will modify my statement like this, the pressure in the apical portion is slight compared with the gingival portion, as the two forces—the outward pressure of the lingual arch and the gingival border—are close together. But nevertheless, it is there and no matter which way the tooth presses on its surrounding membrane there will be movement.

Dr. James McCoy.—I think it is a refreshing thing to get together a body of men who can differ in a very nice way. I want to state one point where you are wrong. Suppose you take a post and put enough lead on the bottom so it will stand straight up and down, when immersed in water with the head out of the water. Let the water represent living tissue. We think of bone tissue as being nonplastic, but we know it is very plastic. The only nonplastic bone is that found in the head (laughter) but the ordinary physiologic tissues through which teeth are moved we know to be very plastic. Exert gentle pressure on the post in the water, and the head of the post will incline away from the pressure. And what happens to the weighted end? It is going to move in a similar direction.

Dr. Bell.—May I ask where the fulcrum is in the problem cited?

Dr. James McCoy.—Nearest the center of gravity.

Dr. Bell.—The point where the lead is suspended becomes the fulcrum.

Dr. James McCoy.—Did you ever read the experimental findings of Oppenheim on tooth movement?

Dr. Bell.—Yes.

Dr. James McCoy.—Do you not remember that he showed the greatest amount of tissue change and tooth movement was toward the upper portion of the root and the least amount of movement toward the apex? The appliances he used were designed only for a tipping movement so there was practically no movement at the apex, but it was from the crown toward the apex, but in the buccal or labial movement of a tooth there was no lingual movement of the apex, even though the crown tipped.

Dr. Bell.—I said the movement of the apices was in proportion as the distance of the cervical border is to the power applied by the lingual wire.

Dr. F. W. Epley.—What would be the effect of a rod or lock lying down over the tooth?

Dr. Bell.—That has a real value in keeping the root in the proper alignment. It is also true that if we could keep a continuous tense masseter muscle over the crown, we could use the lingual appliance successfully always, as that and the bite of the lingual cusp forms the fulcrum and the power applied is between the fulcrum and the root, in which case the root movement would be in the same direction as the power applied.

Dr. H. F. Hoffman.—Does not the force of mastication have a tendency to overcome lingual movement?

Dr. Robert Dunn.—The larger portion of your root is what kind of bone? In the alveolar process, where is the apex? In the body of the bone, it is not? You know there is a big difference between the body of the bone and the alveolar process. When you move the crown of the tooth, there may be a difference in the position of the apex and the crown, but you have tipped your crown mesially, and have not tipped your root distally at all.

Dr. Bell.—Have you ever noticed that when the teeth are closed the buccal cusps are separated and the lingual cusps biting together, due to tooth tipping? The principle is here changed, the lingual cusps become the power, the expanding arch wire becomes the fulcrum, the root, the load, and the root movement will then move in the same direction as the lingual wire.

Dr. A. E. Scott.—Let us go back to the foundation of orthodontia, if it is a state of growth and development, as we think. If Dr. Bell states the truth, we may as well throw away our inside arches. Some of us have expanded the arches from twelve to fifteen millimeters and we know they do move.

Dr. Bell.—Some are exaggerating that movement lingually. I did not say "Do you move the teeth lingually?" But the tendency is there to do that. I was not underestimating the muscular action to counterbalance that force.

Dr. Scott.—A slow gradual pressure will cause root development.

Dr. Meaney.—I should like to go home and check up on this before disputing Dr. Bell.

THE EARLY TREATMENT OF MALOCCLUSION*

By E. C. Read, D.D.S., Long Beach, Calif.

THE subject I have chosen is by no means a new one, but is one that is given added importance by the more frequent use of the lingual wire.

The problem of the proper time at which to start the correction of malocclusion is one upon which there is a wide variance of opinion. Doubtless no definite rule can be laid down and the conditions of each individual case must necessarily enter into the final decision.

The large majority of the men in general practice seem to have gained the idea that the proper time is about eleven or twelve years of age or soon after all the deciduous teeth are replaced by their permanent successors. Whether this has been the teaching of our schools I do not know.

However, I do feel that it is time that we, as orthodontists, should urge our fellow dentist to refer all cases as early as they come to their notice and not to advise delay.

In those cases which we would classify as neutroclusion, or Class I, which are due to lack of growth of the bony structure supporting the teeth, certainly early treatment is indicated.

It would seem reasonable that development could be secured more readily and more normally if we set about to assist as soon as we are sure Nature will not properly care for it. I am not prepared to be as radical as Dr. Bogue, who advocated expansion in all cases where the distance between the deciduous second molars is less than 35 millimeters. Nor have I yet attempted to expand simply because there was not a spacing of the deciduous incisors at four or five years of age.

As soon, however, as we find the permanent incisors erupting and there is not sufficient room, I believe we should start treatment. This ordinarily is about six or seven years of age. At this age the child is old enough so one can gain his confidence and easily fit and adjust an appliance. They seem to be able to wear an appliance with very little inconvenience and seldom have trouble with their bands becoming uncemented, the appliance breaking or getting out of place. In fact, they are easier to work for and less troublesome than the older patients.

It is very evident that, if these cases are not started before the absorption of the roots of the deciduous canines and molars has proceeded to any extent, very little can be accomplished and should then wait until the premolars are in position.

It is true we do not know but that some additional treatment may

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be necessary later but it will only be the adjusting of a few individual teeth and not the development of the entire maxillae or mandible.

We ought not forget that we are not merely making room for the teeth but we are producing a development that changes the entire facial outline, enlarges the antral sinuses and increases the nasal passage and this means more to the health of the child than we are apt to realize.

For these cases the lingual wire, similar to that used by Dr. Mershon, is ideal. The second deciduous molars are used as the anchor teeth. Where the first permanent molars are present (and usually they are), I solder a 19-gauge wire to the anchor band and carry it distally to engage the lingual surface of these molars at the gingival. I also band the canine and unite this band to the molar anchor band on the same side with about a 22-gauge wire. This wire is soldered to the bands either on the lingual or buccal and acts as a stabilizer and prevents any rotation of the anchor teeth. I also prefer, in these cases, the round pin and tube to the half-round, as the form of lingual wire can be changed from time to time, and replaced without the danger of binding one encounters with the half-round wire.

I like this type of appliance because it is efficient, constant in its action, does not interfere with the function of the muscles, does not need frequent adjustment and is not conspicuous.

I usually use a 19-gauge wire for the base wire but a smaller wire may be used if desired. When I wish to secure only lateral development I frequently carry the base wire apically about one-eighth of an inch above the gingival line of the deciduous molars and then across the palate at about the region of the canines. The finger springs are carried forward from this base wire along the gingival of first deciduous molar and canines and supported by a small spur on the canine band. When development is needed labially in the premaxillary region this type of appliance is not indicated, but one such as Dr. Mershon has given us. I believe the tendency is to use too heavy finger springs. The .020 wire is generally large enough but should be very springy but not brittle.

I have had quite a few cases where the mandibular centrals and one lateral incisor were occupying the entire space from canine to canine and in the maxillary, an overlapping, or if the laterals had not erupted, there was insufficient space. These cases should be started as early as possible because the longer they are left the more likely we are to find absorption of the roots of the deciduous canines, due to the pressure caused by the laterals erupting when there is not room enough for them.

In event this has occurred, I believe work should be started provided the deciduous molars have good roots. If absorption of these roots has also progressed to any degree, doubtless, work should be delayed until the premolars are in place.

DISCUSSION

Dr. Allen E. Scott, San Francisco, Cal.—I sometimes wonder whether all this misinformation that is passed out to patients is the fault of the general practitioner, or the orthodontist. It may be the dentist's fault in not knowing the proper information or ad-

vice, or the orthodontist may be to blame for not giving the proper information to him. I recall one case of an impacted maxillary first molar which had to be removed, according to the dentist. He intended to remove the second premolar, then the second molar, then the first molar. But the first molar was brought into place and the patient still has all of these teeth.

I take exception to Dr. Read's figures. My understanding of Dr. Bogue's work is that where the distance between the deciduous molars of the maxillary arch is less than 28 mm. the arch would require additional width. Dr. Read quotes that at 35 mm. Dr. Bogue did not say a case showing a width of 35 mm. would not require orthodontic treatment. He did say in case the width is less than 28 mm. it would require treatment.

In the matter of growth and development in orthodontics I doubt seriously whether we really increase the space in the antrum of Highmore under treatment. I would like to hear a discussion of that later on. If we do increase this space what happens to the patient when all the teeth are extracted? Does the content of the antrum of Highmore decrease? Orthodontia is accepted today as a biological problem, the solution of which is mechanical. If we could get away from mechanics and think of biology many of us would get along much better. We must remember we are treating a condition out of harmony with Nature's plan and our treatment.

Dr. Scott, (continuing discussion).—Dr. Read's paper is mechanical, but it is essentially a biological problem. It is one of development and growth and some men claim that by increasing the functional activity you can correct the malocclusion without any mechanics. That is a bit radical, but it seems to me it may be possible, as we understand these problems better.

I think the development of the arch, being a biological problem, cannot be hurried. It takes from five to seven days for a wound to heal. It takes about twenty-one days for a bone to knit, and no power on earth can cause this process to take place faster. I do not believe where it is necessary to develop both jaws that this process can be accomplished in much less than two years. Of course the cooperation of the patient and the ability of the orthodontist have a great bearing on the subject; but where cooperation is normal I think these cases require from two to three years. I cannot see how this work can properly be done in a shorter time. A general rule to follow is to take these cases when the malocclusion manifests itself. If this cannot be done those responsible for the patient should be so advised. Of course, in this connection it sometimes requires considerable bravery to inform the parent of a child five or six years of age or less that the maxillary and mandibular arches require widening. And it may be a good plan for obvious reasons to postpone the treatment until the parent is convinced the work is necessary.

Dr. John R. McCoy, Los Angeles.—I should like to ask Dr. Read why he would use the second deciduous molar as an anchor tooth where the first permanent molar is present?

Another thing, I do not believe you will often find cases in which the crowded condition of the erupting mandibular centrals and laterals will cause the early loss of the roots of the deciduous canines. I believe early treatment is more often responsible for this condition.

Dr. H. L. Morehouse, Spokane, Washington.—In the matter of early treatment of cases my views have changed more or less in the last year and a half or two years. I used to advocate very early treatment, around four to five years of age. I still advocate it under certain conditions, namely where there is a very marked narrowing of the arch or deformity, with an opportunity to gain considerably from expansion of the arches. But in the average case I think we are justified in postponing the treatment until approximately the time of the eruption of the incisors. By the "average" case I mean, like Dr. James McCoy, that the arches are functioning; there is an ability to masticate, but there is not sufficient room for the permanent incisors. If you take a case where the deciduous arches are said to be about normal, with slight spaces between the canines, I think we can gain as much by waiting until the incisors are about ready to erupt, (as determined by radiograms,) than to start treatment earlier and carry it over a longer period. I have so concluded, after fifteen years of

orthodontic practice. I am not taking cases of this type now under six or seven years. In some instances, however, a year's treatment may be given and followed by a resting period of two or three years, and this may be very well.

Dr. Allen A. Suggett, San Francisco, Cal.—As to Dr. Scott's point about waiting until the parent is convinced of the necessity of orthodontic treatment, I think, this may be very important. I have often had cases of this type come in, and I was certain expansion was required, but to convince parents that there is malocclusion when they only see a beautiful deciduous arch requires a great deal of talk, and in the end you do not feel they are convinced.

Dr. Robert Dunn.—I wanted to ask Dr. Read at what stage in the absorption of the roots of the deciduous teeth he would consider it safe to attempt the expansion of the arches.

Dr. Read.—That is a little difficult to say. One can tell better from the radiograms. I should not care to have very much absorption; if the roots are half absorbed I might hesitate.

Dr. Dunn.—Is it not the idea that stimulation increases bone development?

Dr. Read.—Surely.

Dr. Dunn.—Is it not true that steady pressure would increase stimulation?

Dr. Read.—Yes.

Dr. Dunn.—Then what is the difference whether the deciduous teeth are half absorbed or two-thirds absorbed?

Dr. Read.—It is a matter of doing without apparatus which stimulates there. I have a number of cases where it might have been better to have waited. Very often a period of rest would be in order to await the eruption of the premolars.

Dr. Dunn.—The question is whether there is not too rapid action on the deciduous teeth and how shall we determine what may work in one case and what in another?

Dr. Read.—That depends on the individual case. Dr. John McCoy has indicated one thing that may help to answer the question. There is a tendency, regardless of how gradually we do our work, to cause this absorption. We may cause more than normally rapid absorption through the use of our appliances: and we are on the borderline when there is any considerable amount of absorption taking place, and we should ask ourselves the question whether we had not better wait a time. If we do gain somewhat we may know we shall have to wait for the eruption of the permanent teeth and then continue the treatment.

Dr. Dunn.—I think there is a certain amount of development in the permanent structure to keep up with our treatment. Another point: I think too much importance has been placed on Dr. Bogue's idea as to the width of the arch at the second deciduous molars. Where is the greatest amount of development required in these cases?

Dr. Read.—We frequently find it in both the molar and in the anterior region. I do not even advocate treatment before the incisors are erupted.

Dr. Dunn.—I think too much importance has been placed on that particular thing. Where is the greatest amount of arrested lateral development in your arches?

Dr. Read.—In the anterior part.

Dr. Dunn.—In the canine and the first premolar region. As to the sinuses I do not believe we should tell our patients we are going to develop the nasal or maxillary sinuses. There is no way of determining this, and there never has been any way. Those things may occur but not while you have the appliances in place. It takes time. Do not tell your patients your appliances will accomplish this development. If you will study the structure of the head, the resistance offered by those structures to force applied, the amount of force you will be able to apply and point of application of such force coupled with absorption, you will be able to figure out for yourself the amount of development you will obtain.

Dr. James D. McCoy.—I am glad to hear what Dr. Dunn has to say in regard to increasing the nasal space through orthodontic treatment. Much misinformation has been given to the profession and to the laity along this line. I think the impression has been gotten by certain nose and throat men that orthodontic treatment straightens septums and increases the antral development and nasal spaces and they have handed it on. If changes do take place in this region they are developmental changes, due to increased functional activity of the teeth, and to the increased functioning of the nose and accessory sinuses, brought about through normal respiration after the teeth are established in their normal relations. A definite relationship must exist between the lips, tongue and teeth if true normal respiration is present. As a result of this and the normal functional activity of the teeth, I think we do get some development there through our orthodontic treatment. However, I think, as I stated before, that in this connection a large supply of bunk has been handed out by certain members of our profession to the laity and to the medical profession.

Dr. A. H. Ketcham, Denver, Colo.—Yesterday we were discussing the need for thorough radiodontic diagnosis. I believe Dr. Suggett would have less trouble in explaining malocclusions to parents if he would have radiograms to show the malpositions of the permanent teeth above the deciduous teeth. This is quite illuminating to the parents, and they at once see the malposition of the permanent teeth in the jaw and so are more readily impressed with the importance of early treatment.

In regard to the development of the sinuses, especially the nasal space, I believe that the inception of interest along this line is to be traced to the meeting of the American Laryngological, Rhinological and Otological Society held in Philadelphia in 1912. At this meeting Dr. F. B. Noyes and I gave papers, which were perhaps responsible for fixing in the minds of the rhinologists the fact that the orthodontist through artificial stimulation of the development of the bones of the jaws and face, and through placing the teeth in occlusion and establishing normal function, had in certain cases which were under the close observation of rhinologists over a period of three or four years' time, stimulated development until the nasal space had increased to normal size. One case reported, which had approximately but one half normal nasal space at beginning of orthodontic treatment, showed development of a normal breathing space in three and one-half years' time.

The Chairman has clearly expressed it: "Through the establishment of normal function and through stimulus to the bones of the jaws and face, the nose cavity apparently increases in size so that normal function in breathing is established in children who were chronic mouth breathers."

I think there can be no question at all that through the establishing of normal function we do increase the size of the nasal cavity and stimulate the development of the bones of the jaw and face.

Dr. H. F. Sturdevant, Portland, Ore.—At our meeting in Portland Dr. Kistler read a paper in which he stated that the deflected septum was noted in almost all of his cases at about seven years of age and up. His contention was if we were to benefit the nasal capacity we should do our work before that age.

Dr. H. L. Morehouse, Spokane, Wash.—I would like to ask Dr. Ketcham at what maximum stage of root absorption may we feel justified in undertaking stimulation in the deciduous denture.

Dr. Ketcham.—I think we secure some stimulation whenever the temporary teeth are attached to the tissues firm enough so that slight pressure will influence the spreading of the arches. Of course at that time we would anchor to the first permanent molars, and in my experience the bones surrounding the buccal teeth respond to stimulus through the light spring pressure of the lingual appliance until the teeth are so loose they may be tipped out.

Dr. H. L. Morehouse, Spokane, Wash.—The reason I asked this question is that I believe a good many of the younger men may be helped by receiving some idea of the proper

time to take these cases for lateral development. It has been my custom not to attempt to cause lateral development if the radiograms show the deciduous roots are absorbed in excess of one-third their length. I have felt if there was that much absorption, the stimulation from our appliances would increase the absorption of the deciduous arches to a still greater degree, and we would not accomplish sufficient actual bone growth to make it worth while to carry on these cases over an extended period of treatment, which would be necessary if taken at that time.

Dr. P. T. Meaney, Portland, Ore.—The interval between the loss of the deciduous teeth and the progress of calcification of the first permanent molar, is interesting. The calcification of the roots of this tooth is not completed perhaps until the tenth or eleventh year. Resorption of the second deciduous molar begins about the eighth year. If we anchor to the first permanent molar tooth at that time, with resorption starting on the one and calcification being incomplete in the other, we are in a peculiar position. I have wondered if it would not be a good plan to keep away from that permanent tooth.

The question has been asked why attach to the second deciduous molar when the first permanent molar is in position? What effect does anchorage to this latter tooth have in case its roots are not yet calcified?

Dr. A. H. Ketcham.—If you are going to abuse your anchor tooth, do not use the first permanent molar. If you are going to use it just right, with the right amount of pressure (and the anchor tooth should receive but little pressure at this early age) there is no harm to be feared. Just gentle, stimulating pressure is all that is necessary. Where a little careful thought is used at each adjustment, I can see no harm resulting at all, and a great deal of good. When a bicuspid begins to erupt, if in torso occlusion, slip a band over the crown and rotate before it is fully erupted.

Dr. Read, (closing discussion).—I may be mistaken in regard to the 35 mm. about which Dr. Scott speaks. I think perhaps the Doctor is right in saying when the space between the second deciduous molars of the maxillary arch is less than 28 mm., Dr. Bogue believed development was necessary.

In regard to the antral sinuses, I think that has been quite well taken up. I do not wish to give the impression I assume a position of authority. The question has been much discussed. I did not mean to have it appear you are to open up any suture or anything of the kind, and by pressure produce any gain. It would simply have to come through development, starting during the time of the treatment and continuing on to a later period. But there is a time when the development of the lower part of the face, including the mandible and maxilla, is rapid. If we take a picture of the child, and then of the adult, we have an interesting comparison. Cover the lower part of the face of both and notice the forehead and eyes, and we can see the similarity very well. In the cases I have referred to there was from 15 to 18 months' difference in the models. The picture of the one in which the mandibular right lateral was missing at six years of age, was taken about January 1st, and in April the patient was called to Toronto for about five months. The case was not touched during that period. The maxillary and mandibular lingual appliances were found in condition, with spring pressure as I adjusted same. Not even a band had become loosened. I remarked to the Mother, "I think probably this case has done better than it would if I had seen the patient." This indicated the work Nature did in taking care of this case. I do not believe there is anyone here who will examine these models and accept my statement who will not say it was a wise procedure and the results not better than they would have been had we waited longer.

In regard to the time malocclusion manifests itself, referred to by Dr. Scott, I presume he has in mind the time prior to the eruption of the permanent incisors. I have not taken any cases prior to that time.

In regard to the use of the second deciduous molar as an anchor tooth where the permanent molar is in position asked about by Dr. John R. McCoy: I have anchored to the deciduous molar where its roots are good. I think it is a firm tooth to anchor to under such circumstances. I believe it is more firm than the first permanent molar at six or seven

years of age, although at times I anchor to the first molar. I see no objections to using it. If you use enough pressure to throw it out of line where it has good roots, you would be using too much pressure if your anchorage were the first permanent molar.

As to the resorption of the temporary canine roots, and that being due more to the appliances than to erupting lateral incisors, I have seen numerous cases where the canine was absorbed when the lateral came through and it was apparently due to the eruption of the lateral incisor away ahead of its normal time. I have two cases, one in which the lower right lateral space was completely closed at seven years of age. I expanded the arch and made room for lateral, but lost the right temporary canine tooth when lateral erupted. Perhaps too much pressure was used, but left canine remained firm. In another case, where the lower left lateral was erupting lingually entirely out of place I expanded and made room and brought the lateral into place. The other day the left temporary canine was thrown off and this patient is seven years of age—six when I started. As partial proof I did not cause the absorption by the appliances, the permanent canine is already coming through. No harm is done in the first case as we have made the space, but we will have to maintain it until the permanent canine is erupted.

As to the age of patients: Let us recognize the fact there is a great difference in the development of children as regards age. There may be two years' difference in the time of the eruption of the teeth. We cannot arrive at a definite age on this account.

ART IN DENTISTRY*

By Allen H. Suggett, D.D.S., San Francisco, Calif.

IF you should ask what the incentive is that urges us to do our best work, the answer, nine times out of ten, would be "money." And it is the truth, that answer. But it isn't the whole truth.

The conditions under which we live make money so important that every hope, ambition, and need cries out for money, money. We are taught as children at home and in school to get money. We are sent to college to learn a profession, a trade or a business so that we can make money and so succeed in life. We read in our newspapers, periodicals, books of successful men, and they are money makers. Captains of industry are dined, they are vined at banquets, and their praise is measured by the money they have got. It's an atmosphere of money we live in. And indeed, we have to have money to live and move in the society that counts. It is power, it is prestige, it is a pardon for crime. Men will do almost anything, honest or dishonest, decent or indecent, to get money. They will rob, cheat, graft and profiteer, even during the war. So it seems we have made Mammon our god.

But we worship other gods also. Men are actuated by mixed motives. There are other nobler incentives besides getting money that drive us to effort. Last year, I showed that we dentists were glad to render service, we liked to help our patients, we tried to improve the general condition of a community; and that we did this sometimes when it did not seem to be to our immediate advantage to do it. We are like other men in this. During the war when the great industries were turning out their products for

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huge profits, millions of men gave up their jobs, left their homes and went overseas joyfully to fight, to suffer, to die, and not for money. I think that some of the profiteers who stayed here and got rich, even they started out to serve, not primarily to get rich. The profits of some of the profiteers were thrust upon them.

At any rate, it was not the soldiers in the trenches who got the highest pay. The most dangerous work was not the best paid. And so in the industries of peace, most men—all labor, works for fixed wage. It is only a few to whom we offer the incentive of big money rewards for great effort. I think that we exaggerate the part that big pay plays in our own psychology. I suggest that it is the incentive to high pay that induces men to do wrong, to lower, to hasten, to skip their professional work, to rob corporations, water stock and to corrupt governments. Who would take a chance of being caught in a wrong act except in the hope of a great reward?

Money does urge us to exertion, but look at my question again and put the emphasis on "Best." What makes us do our best work?

If you will look at my question again and put the emphasis on "Best" you will find, I think that one other motive comes into play in all of us, and that other motive is craftsmanship.

The love of art, the love of the beautiful, of accomplishment of service have been the active incentives all through the ages, and they are at work right now, even in this industrial age, which has done more to kill ideals, art and beauty than any other phase that civilization has passed through.

It is marvelous that any trace of craftsmanship survives, for the poor artist is a joke, the lover of the beautiful is a dreamer, the idealist is in jail. Yet, it was the artist that painted the Sistine Chapel, it was the lover of the beautiful that built the Taj Mahal, and it was the idealist that made the slave free.

What prompted the architect to design his great building that is as beautiful today as it was when finished in 1632, or the wonderful painter? It was the love of the beautiful, the desire to create something perfect, an instinct born in all of us, in some way, in some degree, and which we would express, each in his own way if we were allowed.

We see it in the poor Mexican peon who in his poverty and dirt loves to create the beautiful drawn work or the varicolored serapa and filigree work in gold and silver; the patient little Japanese fashioning the delicate damascene; the poor Hindu of Jaypur with his crude tools shaping the graceful articles in brass. They all love to create the beautiful and the artistic, so do we. All the corrupting influences of the industrial age cannot kill that love. Even dentists have it. We have to have it.

Every dentist must have the love of art in generous measures if he would really succeed. No dentist can look at a perfect tooth or an artistic restoration of one without a thrill. No orthodontist can look at a perfect arch without going into raptures and no *real* orthodontist can look at a case of malocclusion without yearning to mold it into a beautiful work of art.

If this appeal of the artistic is not felt, you're not a dentist, you're not

an orthodontist. You should try to express yourself in some other way. You have missed your calling. There is a place in life somewhere in which you can express yourself, and indeed unfortunate is he who cannot find it. When education is freer and broader there will be greater opportunities for each to find his place. There will be fewer misfits, fewer human malocclusions.

The real dentist is just coming into his own for as he has become better educated both in mind and hand, his clients are appreciating more and more the value of his services. What wonderful material to work with; what marvelous possibilities, the young child, full of love and faith, placed in your hands to mold into physical perfection.

What could be more beautiful than a tooth, with its graceful curves, grooves and cusps? How artistic the lines of the arches, how perfectly the two arches fit into each other, how symmetrical the two arches have developed the whole face, when all is right.

This precious jewel is placed in your hand to develop, to keep beautiful and artistic.

If by chance a part of a tooth is destroyed, the restoration must be a work of art. The grooves and curves and cusps must be restored and the symmetry and function maintained. The dentist has a wonderful feat to perform in restoring to normal form and beauty, a mutilated and neglected arch. It requires a fine sense of form, symmetry, color, beauty, art. It is worthy of the highest skill. Each curve must be restored, every cusp so formed that it will fit accurately into the groove that should receive it. Each groove must be hollowed out, not too low or too high to receive its cusp only to its proper depth. The mesiodistal diameter must be exactly restored. The color and the shading must be perfect.

The art required of the orthodontist is no less exacting, and his imagination must be even greater. The little child is presented to him, its arches without form and void. There is no beautiful curve to the lips, the jaws hang down like an animal's, the nose is narrow, undeveloped, functionless; the face is narrow and asymmetric, the throat is inflamed from mouth breathing, and the arches have lost their form, the teeth are in all positions of eruption and impaction.

The orthodontist must have the artistic imagination to picture the face as a symmetrical, balanced, developed whole and he must have the skill to achieve this. He must design an appliance so skillfully that it will cause the necessary movements of the teeth and result in no annoyance to the patient. It must be delicate and constant in its action so it will open up certain spaces and close up others, stimulate bone development that will restore the face, the mastication and the breathing to normal.

This is the art in dentistry; to make the ugly beautiful, to restore health from disease and develop function, and it is a fine art.

The painter projects on canvas the likeness of a beautiful child. The dentist developed the beautiful healthy child. The sculptor carves out a

marble statue, posing in an artistic attitude. The dentist restores the lost functions in that statue, and it moves, it breathes, it sings and dances.

DISCUSSION

Dr. Gray.—I am sure Dr. Suggett always brings forward idealistic considerations that are profitable. I cannot say that they are likely to have an immediate full application in our every day practices, but I have lived long enough to believe that there is a great deal of good in many things and we will do well to garner from such suggestions those considerations that can be applied to our work.

Certainly we are living in a world where we do not get very far until the financial consideration intrudes itself. We either have to receive compensation for our services direct or we have to look to some kind fortune that has come to us through other channels, and which may under exceptional circumstances permit us to perform orthodontic services without particular reference to the fee.

I agree very fully in the idealism of craftsmanship. It has been my own experience that nothing will do so much to enhance our interest in orthodontia as to develop our technic to the highest possible point. I do not need to say that the use of base metals tends quite in the opposite direction. I do not believe a man who is careless and slovenly in his technic will give good service to his patient and his interest in his work is likely to ebb low. Dr. Angle appreciated very fully at the outset of the practice of orthodontia as a specialty the important relationship of an appreciation of art in our work. In his earliest classes therefore he placed on his staff an artist of reputation, and many of us received great inspiration from Mr. Wuerpel's lectures and criticism of the work of the orthodontist in its influence on the human face.

I feel myself that unless we have by inheritance or acquisition a deep appreciation of the beautiful we are not properly equipped for the practice of orthodontia and had better seek our work in other lines.

Dr. P. T. Meaney.— I think Dr. Suggett had a wonderful idea, and I am reminded of the comment on Conan Doyle's assurance that there is a Heaven for dogs and cats; how it might be heaven for the dogs, but it would be hell for the cats.

I noted with interest Dr. Gray's suggestion that many children go through life greatly handicapped because they do not have the opportunities of orthodontic treatment. It is high time, I think, if we cannot place these patients under treatment ourselves to provide some means whereby they can have treatment. What do you do where you cannot afford to treat these patients? Are you turning them away? When the services of the physician are necessary they are given even when there is little or no ability on the part of the patient to pay. What shall we do with these orthodontic cases? I believe we should try to take care of as many as we can, but many receive no attention at all. The fee precludes treatment in many instances.

Dr. James D. McCoy.—Dr. Suggett's paper has struck a sympathetic chord in my mind, because I believe in idealism. There has been no time when we needed idealism as we do now. The dental profession has gone money-mad. I mean it absolutely and literally. The dental profession has gone money-mad! Look at these venders of so-called dental education peddling courses here and there. Why? There is no education motive whatsoever back of it. It is purely and simply to make a few dollars out of well-intending dentists who hope in turn to secure a few extra dollars from those they serve. So again let me reiterate that at no time have we needed idealism as much as we do now.

There was one point in Dr. Gray's story where the old gentleman was asked to pay twenty-seven hundred dollars to the dentist for filling a few root canals and making a movable removable bridge, and seventeen hundred dollars for a plate for his wife. After the dentist had explained his fee on the basis that work like an artist, etc., the old man said "Well, that is all very well but I could not afford to have Michelangelo paint my garage."

So, Dr. Suggett, I wish to compliment you on your paper and on the fact that you have brought out points which should appeal to every man's best nature. There is a Dr.

Jekyll and a Mr. Hyde in every man, and too many are controlled by Mr. Hyde. We had quite a discussion a little while ago as to the possibilities of developing arches by chewing rubber. From appearances it would seem that chewing the rag is almost as efficacious.

I want to refer again to the question of deciduous arches. How many times if Mr. Jones, the banker, brings his child at the age of five, without "growth" spaces in evidence, but with the teeth functioning, is he given that earnest impressive look and the remark "Why have you neglected this child so long?" But suppose it is Mr. Jones, the small salaried man? (This would not apply to anyone here.) Will he be given that same impressive look and advice to engage immediate treatment, or will he be advised to trust the Lord a little longer?

Dr. W. J. Bell.—We take into consideration the financial aspect when we go into business in any line. Idealism is fine. But how many parents who send a son to dental college consider the cost and effort necessary for his education? Four years in college are necessary, with the attendant expenses. Add to this the equipping of the office and he is then just ready to begin to earn his bread and butter. Unless the student is most conservative of expenditures and is a hard worker, if he gets through under ten to fifteen thousand dollars, he is doing well. Of course, it is to be remembered his earning capacity during his college career has been practically nil, so that this estimate makes allowance for that.

Now let those parents hand another son an equal amount of money, and in ten years take stock and see which one has the most money. So we cannot lose sight of the money end of it. I believe in being just. I am treating a number of cases gratis, using the best materials I can secure, but I believe the laborer is worthy of his hire and that dentists should be compensated for the work in hand. We frequently lose sight of the responsibility attaching to every case we place under treatment. Frequently the thought of these cases will follow us into the small hours of the night, if they be difficult. I think the members of our profession are not overpaid. I do not agree with Dr. McCoy that they have gone money-mad. If he had said they had received scant financial recognition in the past he would have been more nearly correct.

No man will do his best, although an idealist, unless he is compensated for his services. The dentist is usually underpaid for the amount of time he puts in and the responsibility entailed. I paid $450 to get my house painted some time ago. Ten days were required to do the work, the materials cost $52, and the labor $398. Not much intellectual effort was entailed there. I am an advocate of just compensation. If you will consider the great length of time the patient is under the care of the orthodontist I think you will agree the average orthodontic fee is extremely reasonable.

Dr. James D. McCoy.—As this has assumed something of the character of a debate, I agree with Dr. Bell to the extent that every one should receive just compensation but remember that high fees do not necessarily mean fine dentistry. A dentist has no right to charge a fee he would not pay himself under similar circumstances and in nine cases out of ten if the dentists charging these large fees had to pay them themselves, they would "literally go up in smoke."

Dr. E. C. Read, Long Beach.—It seems to me the discussion has resolved itself into the question of service. I think Dr. McCoy's point relative to the banker and the baker is a bit unfair and is similar to the question as to how you would proceed with your own children. The banker goes to the automobile dealer and is advised to buy a Cadillac or a Packard, but the baker is not so advised. It is a necessity to the banker, but not to the baker. There is a difference in their respective positions. We often do advise the poor man to wait and pray in case it might save him an extra undertaking. The treatment might not be worth as much to the baker as to the banker. The viewpoint of beauty and appearance is different in the two instances. Then comes in the professional obligation that would make us as responsible to the baker's child as to the banker's child, regardless of the fee. I believe with Dr. McCoy we should not get our fees so high that those who are in meager circumstances or receiving moderate salaries may not be able to take advantage of the services needed. In cases where disfigurement or the question of health is involved we should

take as many patients as we can at smaller fees or gratis. We are the servants of the people and unless we can make our profession worthy from that standpoint without enlarging upon the financial I feel we have failed in our work.

Dr. Suggett, (closing).—Some of the talks have wandered away from the subject. The questions of Dr. Read, Dr. Meaney and Dr. Bell are real economic questions. I have never advocated lowering the fees of the dentist or orthodontist. I am discussing the relative value, placed by custom on the service rendered to society by business and by the dental profession.

The big business man justifies his big income by claiming much brains and ability. He claims to be an expert.

How about the physician, for instance, who takes four years in the academic, four to six more years in medicine, after that one or two years in intern and special work? Then after ten to twenty years of practice, he should according to the brain theory be able to render service equal in value to the most successful business man. But how do their fees compare? About one to ten.

It's the big leaks that should be looked after first, then the small ones will disappear.

There is very little cooperation in the world today. The big privileges go to the group that is able to demand and take them.

At different times history tells us that different groups had control and took all the traffic would bear. At the present time the industrial group have control and they pay themselves well. That phase of culture will pass. In fact we are right in the midst of a change of culture. It is a change from competition to cooperation.

Our problem is to place healthy mouths in the reach of every child in the world. It is a big job but a glorious one and will come about by the solving of the social problem.

BONE CELLS IN RELATION TO BONE GROWTH AND REPAIR*

By Dr. Theodore H. Bast, Madison, Wis.

WITH the presentation of the cell theory by Schwann, in 1839, was inaugurated a period of intense study of all tissues, in order to note their cellular nature and to determine what rôle the cell plays in the growth of the tissue. It was during this period that the accounts of bone structure and growth were formulated by Howship, Havers, Volkmann and H. Joseph, which today are presented in our texts and taught in all of our schools. Of course many controversies have arisen regarding the conception of bone structure. But because of the methods and technic used for the study of a tissue so resistant to histological manipulation, no other conception has been presented, even in the face of contrary clinical indications.

Bone surgeons have, during the last ten years and especially during and since the late war, made almost miraculous progress in the treatment of bone disease and in the control of bone regeneration. Because of this work, many questions have been reopened which do not seem to be adequately answered by the present explanations of bone structure and growth. Foremost among these are such questions as: "Is the periosteum essential to bone regeneration?" and, "If regeneration does take place, what type of bone is formed?" Such questions have recently awakened in the anatomist the sense of duty to review the subject of bone, to determine whether or not some new light could be thrown on these problems.

The question which has always been foremost in my mind, and which seems to be almost ignored in our accounts of bone, is that of the relation of the bone cell to the bony matrix in which it lies. The reason why little importance has been attached to this little body lying in the bony substance is, I believe, of a two-fold nature; first, because it is hard to conceive how a cell enclosed by bony prison walls can function; and second, but more important, because the technic employed has given erroneous pictures of the actual structure of the bone cell and its relation to the bony pocket in which it lies. Let us briefly review the methods of bone study and their result.

PAST METHODS USED IN THE STUDY OF BONE

Two types of preparations have been employed in the past, namely, decalcified and ground bone. Embryonic bone has been cut without decalcification, but the study of such preparations has apparently failed to contribute anything to the knowledge of bone cells. For the study of the bone cells the ground bone method is of little use except to show where the cells were. The method upon which is based our present knowledge of the bone cell

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is the decalcification and section method. It is upon this decalcification method, which nearly always causes distortion of tissue, that the following accounts are based.

LEWIS AND STÖHR VIEWS ON BONE STRUCTURE

In the "Textbook of Histology" by Lewis and Stöhr, the following statement is made:

"Active osteoblasts tend to be cuboidal or columnar, but as bone production ceases, they become quite flat. They form bone only along that surface which is applied to the matrix. As the strand of bone grows broader through their activity, it encloses here and there an osteoblast, which thus becomes a bone cell. (Fig. 92.) Apparently bone cells do not divide, and if they produce matrix, thus becoming more widely separated from each other, it is only to a slight extent and in young bones; they are therefore quite inactive. Each bone cell occupies a space in the matrix, called, as in cartilage, a lacuna, but unlike the lacunae of cartilage those in bone are connected by numerous delicate canals, the canaliculi. In ordinary specimens the canaliculi are visible only as they enter the lacunae, which are thus made to appear stellate. The matrix around the lacunae resists strong hydrochloric acid which destroys the ordinary matrix, and so may be isolated in the form of 'bone corpuscles.' The 'corpuscles' correspond with the capsules of cartilage, which may be isolated in the same way. The bone cells nearly fill the lacunae and send out very slender processes into the canaliculi. These may anastomose with the processes of neighboring cells, as can be seen in the embryo, but it is doubtful if this condition is retained in the adult. The processes, moreover, are so fine that ordinarily they are invisible."

JORDAN VIEWS ON BONE STRUCTURE

Jordan makes the following statement:

"Both in and between the lamellae are many small ovoid spaces which are partially filled by small flattened cells, the bone cells; these spaces are known as lacunae. From each lacuna minute canals, the canaliculi, radiate in all directions, thus placing the lacuna in open communication with its neighbors, and eventually with the lymph spaces of the central Haversian canal. The branching processes of the bone cells frequently project for a short distance into the canaliculi. These cytoplasmic branches are more numerous in newly formed bone; later they are retracted and the cells become more or less shriveled in appearance."

These two accounts typify in general the accounts given in other texts on histology. Such views are based on preparations of decalcified bone. The picture by Joseph of a bone cell partly filling a lacuna is taken by most authors as the ideal.

THE AUTHOR'S TECHNIC FOR BONE STUDY

For years I have been desirous of finding some method to overcome the evils of decalcification, but the material which occasioned this investigation presented itself in an entirely unlooked for manner. While investigating the glands of a dog's nose the thin lamina of bone of the turbinates and the ethmoid attracted attention. Curiosity led to a number of experiments which proved interesting. After trying a number of stains and manipulations in order to obtain differential preparations, the following procedure gave satisfactory results:

(1) Fix small pieces of thin bone in 95 per cent alcohol.

(2) Wash in water.

(3) Stain for 8 to 24 hours in a dilute aqueous solution of gentian violet. (The stain should be diluted until it is transparent when viewed in a test tube.)

(4) Wash in H_2O for 12 hours.

(5) Dehydrate as rapidly as possible in 75 per cent, 95 per cent and absolute alcohol.

(6) Clear in benzol.

(7) Place in a watch glass of benzol and carefully scrape off all of the periosteum under a binocular microscope.

(8) Mount in balsam.

The advantage of gentian violet over other stains lies in the fact that bone cells stain very intensely while the matrix remains unstained. The deep stained cells with all their protoplasmic processes within the clear white bone give a very striking picture. The older the bone the greater the contrast. This is probably due to the fact that the bone cells are farther apart and the abundant and more compact bone is less prone to absorb the stain. Among other stains that were used, neutral red gave similar results but the contrast is not as great because the cells are not stained as intensely as with gentian violet.

When bone from which the periosteum has been removed is stained, the picture is not so clear. The denuded bone apparently absorbs some of the dye. With the periosteum intact, the stain will not diffuse through the osseous matrix. Before attempting to study such sections it is very important that the periosteum be carefully removed. The outer or limiting membrane is easily removed, but the inner part of the periosteum is not membranous but more granular and adheres firmly to the bone. It is this inner layer that takes the stain deeply and unless removed obscures the details of the bone itself.

The bones employed in these investigations were thin lamina from the turbinates and ethmoid bones of both young and adult dogs; the parietal and nasal bones of young cats and rabbits; the parietal bones of mice and rats, thin pieces of young rat femur; and the thin lamina of bone from the human ethmoid and from the walls of the human sphenoidal sinuses. A complete series of parietal bones of fifteen rats, ranging from one to fifteen days old, were studied. This series was taken from two litters, the one of eight and the other of seven. Fresh bone was also studied with good results. The refractive index is sufficiently different to permit one to distinguish between cells and matrix. All of these preparations, even the parietal bones of half grown rats and three weeks' old kittens are thin and transparent enough to permit examination with oil immersion lenses.

MICROSCOPIC EXAMINATION OF BONE

The pieces of bone for this study varied in thickness from one to four times the thickness of the bone cells. In such preparations cells are found at various levels. With a 16 mm. objective the cells appear very small, and since a low power lens permits a considerable depth of focus the several

layers of cells are brought into view, thus often confusing the true relationship. The 4 mm. and the oil immersion lenses are good, the oil immersion giving the most satisfactory results. The depth of focus is much less than that of the diameter of the cell and so a clear focus can be obtained of any part of it. The structures lying below or above a given focus appear quite transparent when a strong light and an open diaphragm are used. Only those cells which lie in the same plane of focus are visible. By slowly changing the focus the relation to other cells at other levels can be established. Since the osseous matrix is unstained or only slightly tinted, the deeply stained bone cells with their anastomosing protoplasmic processes produce the picture of a syncytium.

The value of this type of preparations may be summed up as follows:

(1) Bones need not be decalcified to obtain preparations fit for oil immersion study.

(2) No sections need be cut, but bone can be studied in its entirety.

(3) Bone can be examined fresh with water immersion lenses.

(4) The bone cell, with all of its processes, can be viewed with great clearness without being subjected to the severe and distorting action of acids.

(5) The simplicity of the method and the clearness of the picture of the bone cells make it a valuable method for histological purposes.

A BONE CELL. WHAT IS IT?

Before we go any farther let us determine what we shall call a bone cell.

According to the generally accepted view, a bone cell may be defined as, "a modified, functionless or antiquated osteoblast." The osteoblast or so-called bone-former is a characteristically modified fibroblast. Certain of these fibroblasts become rounded and are transformed into osteoblasts which arrange themselves on the surface of the bone spicules where they deposit osseous substances. The origin of the fibroblast is somewhat different in the two types of bone. In membranous bone the fibroblasts arise *in situ* from the mesenchyme while in cartilaginous bone they are carried by the osteogenetic buds into the areolae of Sharpey from the perichondrium. T. W. Todd, however, would have the fibroblasts of cartilage bone arise *in situ*. Thus he says: "Osteoblasts do not enter skeletal tissue along the blood vessels' tracks, but are fibroblasts or connective tissue cells which have undergone certain characteristic modifications and may or may not have passed through the chondroblast stage." This view is also held by Macewen.

Whatever stages the fibroblast may pass through in order to become an osteoblast, does not directly concern us; the transformation of the osteoblast into a bone cell is of greater importance. According to current views the osteoblast deposits bone only on that surface which is in contact with bone spicules. When one of these osteoblasts becomes aged, worn out, or inactive it is gradually surrounded by the osseous product of those osteoblasts which remain active. When this stage is reached the term osteoblast (bone former) is discarded and the term bone cell is used. Thus, bone cells

are passive protoplasmic bodies lying in bone pockets, called lacunae. It is to this cell, lying within the lacunae, that we shall turn our attention.

Thus we see that the bone cell is regarded as a passive, worn-out structure, and according to this conception any regeneration or growth must come from exogenous sources, and hence the theories that growth and repair originate from either the periosteum or from osteogenetic buds.

While there is much evidence that exogenous growth does take place, especially in the perichondral ossification of long bones, it shall be my endeavor in the course of this paper to show that endogenous growth and regeneration of bone is at least possible and very likely probable. While as yet I can present only structural or indirect evidence, I can do so with a considerable degree of evidence because it is in accord with clinical findings. In a recent letter from Dr. L. H. Kornder of Davenport, Iowa, is a statement in effect as follows: "It is gratifying to note from your recent publications on bone, that your research indicates that growth and repair of bone take place in a manner which clinicians have for some time felt to be the actual method."

Let us then, briefly, study bone, prepared according to the above technic, from a structural standpoint.

SHAPE AND SIZE OF BONE CELLS

The shape of the bone cell is usually stellate with a more or less elongated body; but differences in shape depend on the age of the cells. Gross sections of the parietal bone show that the bodies of bone cells are not flat, but round or oval. Very young cells are more rounded, much like the osteoblast and the processes are short or sometimes even absent. In older cells the stellate shape is very marked. The size of the cell body varies from 10 to 18 micra in diameter although some polynucleated cells measure more. In young cells the average diameter is greater than in older cells. In young cells many are about to divide, and that may be the reason for the difference in their size. This seems to be substantiated by the fact that in the very young parietal bone of the rat, some groups of cells are very large, while other groups are rather small. These large cells usually have nuclei which have or are about to divide. The groups of smaller cells show signs of having passed through a stage of rapid division. Both of these groups of young cells can be found near the periphery of the growing parietal bone. The difference in size however is not entirely explained by the stage of proliferation, because a difference in size is observed in the oldest cells of two different ages. In the one-day-old rat the cells at the center of the parietal bone—these are the oldest cells—are large, measuring from 15 to 16 micra in diameter. On the other hand the cells near the center of a 15-day-old rat measure about 12 to 13 micra. Another interesting fact is that the cells of the 15-day-old rat are farther apart than those of the one-day-old. This difference can also be seen between the peripheral and central cells of a given young bone. Thus the central cells are widely separated while those more peripherally located are separated but a little.

A series of young rats, up to three and one-half weeks old including the series already mentioned, bear out these observations. The younger cells as a rule are large and close together while the older cells are small and far apart.

RELATION OF CELLS TO LACUNAE

In all of the preparations, fixed in alcohol and carefully passed through all steps of the outlined technic, the cells completely fill the lacunae. In preparations which were carelessly handled or allowed to become dry at any time the cells were retracted from the bony wall. It appears therefore that the term lacunae has no significance other than a place occupied by a tissue cell. Thus, in any tissue, when a cell is removed, a pocket is left which might be called a lacunae with the same degree of correctness as in bone, except that due to the plasticity of most tissues the space would collapse.

PROTOPLASMIC PROCESSES OF BONE CELLS

Not only do the cell bodies completely fill the so-called lacunae but the cell processes fill the so-called canaliculi also. In older bones these communicating processes are much finer but there is no indication that they are retracted. In young cells the processes are short and broad at the base and the protoplasmic continuity is unmistakable. The protoplasmic continuity is also shown in older bone structures. In young bone which may be of great importance when functionally considered are the large protoplasmic masses destitute of a nucleus but connected to the cell body by a narrow process. In older bone such masses are rare; but in their places one finds slight enlargements at the points where the anastomosis of several processes occurs. While most processes anastomose, many of the processes do not anastomose, but end blindly. Mounts of entire bone also make clear the fact that the processes do not lie in one plane only, but that they radiate in all directions to anastomose with the surrounding cells.

THE CYTOPLASM

The cell protoplasm is of a finely granular nature. Most preparations show a lightly stained, less granular cytoplasm immediately surrounding the nucleus. External to this is an area containing numerous coarse, highly refractive granules. These granules become fewer toward the periphery but some of them can be found even in the larger protoplasmic processes. There is no sign of lacunar spaces or empty canaliculi but the granular cytoplasm is everywhere in contact with the clear bony matrix.

THE NUCLEUS

The nucleus is normally of an oval shape and is eccentrically placed. Many of the nuclei are shaped differently, but such shapes depend on the stage or type of amitosis which they represent. The nucleus is very rich in chromatin which is grouped into smaller or larger masses and irregularly distributed.

MULTIPLICATION OF BONE CELLS

In all preparations,—including nasal bones of dogs, cats, and rabbits; ethmoid and sphenoid of man; parietals of the mouse, rat, rabbit and cat; and the femur of young rats,—some stage of either nuclear or cytoplasmic division, or both, can be seen. The different stages of nuclear division are very common and cytoplasmic division is common in young bone. From a previous statement that bone cells form a syncytium it will be clear that cytoplasmic division is not complete in most cases. Since many of the protoplasmic connections break early, it is conceivable that all such connections between two sister cells might break. However, I am unable to show such a condition. The constriction however is so real, that the process of cell division is complete, except for a fine connection process. In all observed cases of nuclear division the method, without exception, was that of amitosis. The constricting or dividing nucleus showed no signs of chromatin rearrangement and the nuclear wall was complete at all stages.

In the region of newly formed bone, multiplication is rapid and often forms strings of cells. These rows of cells are especially seen along the walls of blood vessels radiating toward the periphery as in the parietal, or lying parallel to the long axis of the bone as in the femur. Many non-nucleated masses of cytoplasm are seen, which are attached to the main cell by only a narrow cytoplasmic connection. The largest of these masses is interesting because it contains a small amount of nuclear material and a faint strand of nucleoplasm extends from the main cell nucleus toward this outlying mass of protoplasm. Most of these masses contain no nuclear material. They seem to be pinched off from the main cell by rapidly forming bone matrix in the region of the constriction. The mass containing the nucleus may have been formed in such a way, but carrying with it a portion of the nucleus, or it may be the result of cell division followed by degeneration. This latter interpretation is in accord with Haour's statement that many bone cells degenerate to form phosphoric acid which is essential for the deposition of bone.

SUMMARY

The essentials of these observations may be summed up as follows:

(1) Bone cells are not flat, but oblong or rounded bodies, with protoplasmic processes radiating in all directions. These observations are based on total and cross sectional mounts of the parietal bone.

(2) The size of the cell depends on the state of proliferation and on the age of the cell.

(3) Bone cells are further apart in old than in young bone.

(4) The bone cells completely fill the so-called lacunae and canaliculi.

(5) The large protoplasmic masses, lying in the bony matrix of young bone and which are connected to the main cell by narrow strands of protoplasm, are hardly seen in old bone.

(6) Protoplasmic processes of one cell communicate with similar processes of neighboring cells.

(7) The protoplasm is finely granular, but larger, highly transparent, granules are often seen toward the periphery of the cell.

(8) The nucleus is rich in chromatin which is grouped in masses and irregularly distributed.

(9) Bone cells multiply.

(10) The multiplication is rapid in young bone and slower in old bone, but the method of division is always that of amitosis.

So far we have considered the question from an anatomical standpoint but the clinician wants a functional explanation and I feel that it were well if more anatomists would consider structure from that point of view. I sincerely wish that I might be able to answer this important question of bone cell function, but more positive evidence must be obtained before a conclusive statement can be made. However, in the foregoing description there are many points which afford strong indirect evidence that the bone cell is an active body and is in some way concerned with bone production. This evidence is found:

(1) In the intimate relation of cells to lacunae and canaliculi.

(2) In the fact that bone cells are larger and closer together in young than in old bone.

(3) In that protoplasmic masses which are numerous in young bone are almost entirely absent in old bone.

(4) In that bone cells multiply.

RELATION OF CELLS TO LACUNAE AND CANALICULI

The view that the bone cells partly fill the lacunae and that the canaliculi are for the most part empty is held by almost all anatomists. In his Textbook of Histology, Schaffer refers to Joseph's picture as a typical example. He says, "The cell almost fills the lacunae and may send processes through the canaliculi to anastomose with neighboring cells." It is interesting, however, to note that in commenting on Virchow's statement that the capsules of bone cells were homologous with those of ordinary connective tissue cells, he remarks, "To this may be added that the enclosing lacunae and canaliculi are to be looked upon as corresponding to the cell-space of that tissue." Ranvier thinks that the canaliculi are hollow tubes. Ch. Robin writes that processes extend into the canaliculi in primitive bone but that in old bone the canaliculi are empty.

Among all of the earlier writers nothing is said regarding the function of bone cells; they are rather regarded as functionless, antiquated osteoblasts. This view is held by Gegenbaur, Kolliker and Schaffer. They hold that the osteoblast secretes the matrix. Waldeyer and Retterer describe the matrix as a differentiation of the peripheral protoplasm of the osteoblast. Of course it can be readily seen that if the bone cell lies within a bony prison wall with no direct connection with it that it is difficult to ascribe any function to it.

While most anatomists still hold to this view, there are some who, during all of these years, have made statements that stand midway between the

passive and active conception of the bone cell. In Keibel and Mall, Bardeen, whose observations were on embryonic tissue, states, "The endoplasmic units, or bone corpuscles, have branched processes which anastomose freely through the canaliculi with those of neighboring cells." Renaut presents results which affirm the theory of protoplasmic continuity. He fixed bone in alcohol and also in osmic acid fumes and decalcified in chromic acid or picric acid. In such preparations he found that most lacunae were filled by the bone cells. He obtained his best results with the operculum of cyprins which he fixed in alcohol, decalcified and delaminated. In this way he was able to see the relationship of cells within the lamina. Apparently he got results from the decalcified, delaminated operculum similar to those obtained from the thin bones of man, dog, cat, rabbit, rat and mouse which were subjected to no chemical treatment except alcohol fixation. Retterer realized that acid treatment of bone destroyed the actual structure of the cell. He made various attempts to overcome this. He studied small fragments in glycerine and then com-

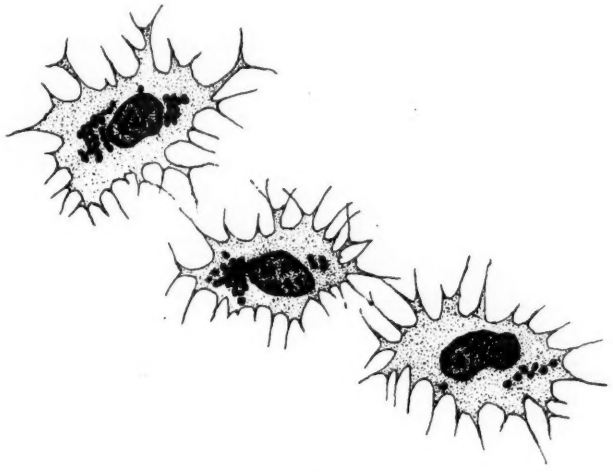

Fig. 1.

pared them with sections properly fixed. He observed that the cells and processes completely fill the cavities in the bone. With his description of the structure of the cell, however, I am not able to agree. He found that the central portion of the cytoplasm is dense, containing a large amount of chromatin, while the peripheral portion is clearer with some strands of chromidial substance radiating from the central portion. Such pictures are common in total bone preparations which have been scraped or also in chips of bone. However, they are always found at the surface where air and fluids come in direct contact with them or sometimes in cases of improper fixation. Such pictures give the impression of protoplasmic coagulation or shrinkage. In fresh bone examined in normal salt solution or in well preserved bone the cells always fill the lacunae.

If then, as these men have in part indicated and as my preparations show, the bone cell and all of its processes are in direct continuation with the bony matrix which surrounds them, just as the connective tissue cell is in direct connection with the connective tissue matrix, then it is difficult to consider it

as a passive senile structure. According to the old view the canaliculi were the important channels through which the bony matrix was supplied with vital fluids but if these so-called channels are completely filled with protoplasm, this explanation cannot hold. The only explanation that we can give in this case is that the cell itself is the important factor for food dissemination.

EXPERIMENTAL DETERMINATION OF BONE CELL ACTIVITY

The protoplasm ingests the food and distributes it to the surrounding structures with which it is in direct continuation. That the bone cell actually has this ingesting power was shown in a simple little experiment which I performed a short time ago. I took a young rat about one week old, made a pin-hole in the parietal bone with a syringe needle that contained some India ink. The wound was thus marked. Three weeks later the rat was killed. The ink spot had spread some. The pin-hole was closed by fibrous and cellular tissue but no bone formations. The cells all around were more or less filled with small droplets of ink. (Fig. 1.) In places where little ink was present only the cells contained it. In places where there was much ink the cells contained large numbers of these droplets while the bone matrix contained irregular masses of ink in the interval between two or more cells. Apparently the cell ingested as much of the ink in its field of control as possible.

BONE CELLS ARE LARGER AND CLOSER TOGETHER IN YOUNG THAN IN OLD BONE

Little more need be said regarding the functional significance of this relationship than has already been said in our description of this condition. Why should the cell be smaller in old bone than in young unless it is because part of it was expended in the production of bone? The reason cells are farther apart in old bone than in new bone may be two-fold. In the first place it may be due to the fact that the periphery is changed over into bone, thus increasing the bone between two cells and as a result the distance. In the second place it may be, as Haour suggests, that some of the cells degenerate in order to liberate phosphoric acid which seems to stimulate or aid directly in the production of bone. This latter condition I have not observed except in cell fragments of which I am about to speak.

PROTOPLASMIC MASSES ARE NUMEROUS IN YOUNG BUT ALMOST ABSENT IN OLD BONE

As already stated, protoplasmic masses of various sizes lying in the bony matrix and connected with bone cells by narrow protoplasmic processes are very common in young bone. These masses are formed by unequal division or cell fragmentation. In some cases nuclear fragments are present. In old bone these structures are absent. What has become of them? Two processes are possible. First, these masses may degenerate, as Haour suggests, to liberate phosphoric acid which is essential in the ossification process. Second, the periphery of these masses may be gradually converted into bone and since the masses are small they are thus completely consumed, leaving only a slight enlargement in the protoplasmic process. Therefore the absence of

these masses in old bone is strong evidence that the bone cell protoplasm is a functional element in bone production.

BONE CELLS MULTIPLY

We have mentioned three lines of evidence that bone cells function, but of even greater importance is the fact that bone cells multiply. In Lewis and Stöhr's Textbook of Histology we read, "Apparently bone cells do not divide." Haour tells us that bone cells degenerate but he says nothing of their multiplication. Apparently Schaffer did not believe in bone cell division for he writes, "The canaliculi, which are at first short, are afterwards extended by absorption so as to anastomose with those neighboring lacunae." If cells came from a mother, but never completely separated, then the protoplasmic or canalicular connections would be present from the beginning of bone formation. Bonome claims that under certain conditions where a rich supply of blood is present, bone corpuscles may give rise to osteoblasts. Bonome made his observations on regenerating bone. Macewen agrees with Bonome on this point. Macewen believes also in the multiplication of osteoblasts but it is difficult to determine whether this proliferation occurs in the osteoblast only or in the bone cell also. According to the following account the actual bone cell does not multiply but has the proliferating potentiality.

"As long as the bone cell remains embryonic, it exhibits the power of proliferation; but when it reaches maturity, it assumes the fixed tissue type and becomes stationary." Thus according to him, adult bone cells do not divide but possess the proliferating potentiality which property is made use of by cells bordering on an injury.

I have already stated that in all of my preparations cell division occurred. It may throw some light on the question of function if we note to what extent this division goes on in young and old bone.

RATIO OF DIVIDING TO NONDIVIDING CELLS

In order to obtain a somewhat accurate idea of the ratio of dividing to nondividing cells, it is necessary to consider both young and old bone. This study, however, yields only generalized results, since the ratio shows considerable range of variation in different bones and even in different regions of the same bone. Thus in the ethmoid bone of an adult dog the greater number of cells show no signs of division; in some fields none, while in others as many as one cell out of every three are in some stage of division. In the parietal bone of a 21-day rat a considerable range of cell age is encountered and it shows that dividing cells are more abundant in the younger than in the older area, yet in both regions the proportion is quite variable. This variability is also obvious in very young bone, although in it most cells are in some stage of proliferation. Apparently this dividing process is a periodic affair as shown by the fact that in a given region, especially in young bone, all the cells are practically in the same stage of proliferation. Because of this variability the exact ratio of dividing to nondividing cells cannot be given. It may be stated, however, that in young bone such as is found in one

to twenty-day-old rats, proliferating cells are so abundant that almost any stage of division can be found without difficulty. In older bone this occurs with less frequency.

DISCUSSION

It may be hard to comprehend how bone cells enclosed in a prison wall of bone can multiply. It is more difficult still to interpret the many stages of nuclear and cytoplasmic cleavage in any other way than by cell multiplication. When we consider, however, that young bone is quite soft and pliable and not so extremely different from other dense tissues, except that some lime salts are deposited in it, it will become apparent that cell division and expansion is not as impossible as it at first seemed. The fact that cell bodies are farther apart in the old than in the young bone adds to the evidence that a change or movement, such as occurs in growing tissue, must take place. It might be argued that the tissue which I have described as young bone, is not bone at all, but only unossified matrix. To this we must reply that these preparations conform to mechanical tests for bone. The staining specificity also supports this view. Gentian violet, which stains most tissues intensely, does not stain bone at all, or only very slightly. All of the observations were taken from parts of the preparations where, according to these methods, bone was present. The matrix between the cells and processes of young bone was unstained just as in bone from an adult animal. This point is still further established by the fact that toward the periphery of young parietal bones the cells were close together but the matrix which surrounded them was stained so deeply that they were recognizable only with difficulty. Most of these cells are more rounded and at least partly surrounded by uncalcified matrix. It almost seems as though Macewen's observations were much like the above except that he considered the cell an osteoblast as long as it was dividing. If this be the case he failed to recognize that ossification set in before proliferation of cells ceased.

The above given observations of bone cell division are, however, not entirely new. They are only an extended affirmation of the observations of Nowikoff in the bone of the newborn mouse. He states definitely that bone cells completely surrounded by matrix really divide. He gives two figures on page 369 of his article. Figure "a" is a very good picture of both cytoplasmic structure and nuclear division but figure "b" shows signs of cytoplasmic coagulation. The reason for these two different pictures is without doubt due to the fixation. The former was fixed in alcohol while the latter was fixed in sublimate. He makes no reference as to the functional meaning of this.

As early as 1873, Z. G. Strelzoff showed that under certain conditions slight interstitial growth may take place. Jean Haour expressed the view that osteoblasts are not the active bone formers, that they, together with the fibroblasts, produce a hyaline matrix; but that the engulfed bone cells are concerned with the bone formation. He claims that many of these bone cells degenerate and liberate phosphoric acid which has a special affinity for cal-

cium. Haour states that Gardner has shown that certain highly refractive granules in bone cells liquefy and that this liquid is directly concerned in the process of ossification.

In 1901 Fujinami, in his paper on "Tissue Changes in Healing of Bone Fractures," writes:

"In sparrows I saw at times a nucleus in the middle of an elongated spicule of ossific ground-substance, both sides of which were closely lined by osteoblasts. The nucleus, whose shape very nearly resembled that of the spicule, showed a rim of finely granular protoplasm, which, without a sharp boundary, gradually passed over in all directions, especially in the long axis, into the ground substance." He also found in his stained preparations that the osteoblasts were differentiated very sharply from the spicule on which they were lying. He implies in this description that the bone cell rather than the osteoblast is the active bone former.

That the bone cell is not entirely inactive is certainly brought out by many of these observations. Its exact relation to bone formation, however, is differently expressed by these observers. Haour attributes bone formation to the degenerating cell. Gardner attributes it to the granules in the cell. According to Fujinami the peripheral protoplasm gradually passes over into bone.

Many of the observations presented in this article affirm the position that the bone cells are actively concerned in bone formation. What the exact relationship between matrix and bone cells is I am unable to say at the present time.

The structures these preparations show, which indicate that bone cells are active in bone production, may be enumerated as follows:

(1) Bone cells are in direct continuity with the matrix in which they lie.

(2) Bone cells are much farther apart in old than in young bone.

(3) Bone cells as a rule are somewhat smaller in old than in young bone.

(4) The large protoplasmic masses which lie in the matrix of young bone are almost absent in old bone. This may either indicate that they are used up in bone formation or it may have some bearing on Haour's degeneration theory.

(5) The fact of cell multiplication certainly indicates cell activity.

DISCUSSION

Dr. E. H. Hatton, Chicago.—No other phase of histology or pathology is of more significance to the thoughtful dentist today than the response of the hard structures of the mouth to stimulation, malnutrition, irritation and insult, and may I include herewith those cells that are immediately concerned with the growth, metabolism, and dissolution of these same hard structures.

Pyorrhea is said to be the result of premature absorption of the alveolar process. It is claimed that by using a certain type of pulp removal one may confidently expect bony closure of the unfilled apical portion of the pulp canal. Many hope that the resected apex of an infected tooth will be replaced by healthy hard and soft tissues. And the art practiced by the members of this Society is based entirely upon the response of these same tissues to force cleverly and intelligently applied. Upon these premises I venture the opinion that any contribution to a clearer knowledge of these structures is of supreme importance to us, who

are concerned about dental progress, and the further opinion that our essayist has given us a more substantial foundation upon which to base our practice, as well as our investigations of cause and effect in dental disease.

In the first place, his technic has enriched instruction in dental fundamentals, both from the point of view of the teacher and the student, be the latter an undergraduate or the graduate anxious to become most proficient in his chosen specialty. Bone cells, or the more highly specialized closely related cells engaged in the production of enamel, dentin, and cementum are the units, the proper composition of which results in a tooth. Their anatomy, therefore, as well as their life-history, must be very familiar to us. Perhaps it is even possible that by this technic we may acquire new information about the very young tooth embryo, or about the extent to which the cementum or dentin is permeable to substances in solution.

This paper interests me because of constantly recurring pictures like the author's illustrations in sections made from teeth, some with partly filled root canals, some from patients suffering with pyorrhea, or with advanced caries. All have to do with the reduction of the diameter of root canals by secondary deposits of calcium salts in which figures like these described by the author are seen. In a few teeth I have found such figures scattered about in the dentin, more numerous near the apex and adjacent to the pulp canal. Illustrations of the former have been published, but the latter I have not seen described. Are these bone cells? Are bone cells normally or occasionally present in the pulp? If the latter, do only such teeth as possess these cells in the apical pulp offer a good prognosis for conservative dentistry? These I know are not matters that intimately concern the orthodontist, but they are questions so intimately connected with the subject matter of the paper I am discussing, as to further emphasize the consideration this audience should give to it.

Now, I am not in a position to discuss the more or less revolutionary matters which have been presented by the essayist as to whether or not bone cells multiply *in situ;* as to whether or not they continue to function after calcification has occurred and as to whether or not they decrease in size after they are located in the position that they occupy in bone. Nevertheless, I am inclined to think if he is not entirely correct, at least he is correct in part.

I have often wondered why it is that teeth, when they are fractured, do not heal like long bones. Perhaps there is a possibility that certain types of teeth may heal under certain conditions after injury or after certain kinds of injury. His paper offers us some information as to what we may expect after pulps have been removed and fillings have been replaced in cavities formerly occupied by the pulps. If his statement is correct that bone cells occupy spaces in bone, called lacunae, with processes extending in various directions and anastomosing with other spaces, and that these are occupied by soft tissue, living cells, then teeth with dead pulps are not dead teeth; they simply have devitalized pulps, because these same cells are occasionally found in the dentin and the apical cementum of such teeth.

Dr. M. N. Federspiel, Milwaukee, Wis.—This work presented by Dr. Bast is in the stage of developmental research, and like all research work, one cannot adequately and intelligently discuss it without having made investigations along the same lines. Therefore, we have to accept the work of a research man as he presents it. If we have done some research work ourselves, we can then offer constructive or destructive criticism.

I am obliged to take issue with the remarks of the gentleman (Dr. Hatton) who opened the discussion concerning pyorrhea. I do not like the term pyorrhea to begin with, because it is a symptom, and not a disease, and when we speak of symptoms as a disease, we may speak of fever or dropsy as a disease.

Overstimulation produces death of tissue, while slight stimulation produces growth. In a case in which infection takes place by destroying the gingiva, a gingivitis is produced. If it is carried a step farther, with the result of invasion of bacteria, the gingiva and pericemental membrane may become involved, and a gingivopericementitis is produced. In cases of gingivitis the prognosis is favorable, while in gingivopericementitis it is not so favorable, yet we can cut away some of the hypertrophied, or irritated gum tissue and by excessive cauterization prolong the life of the tissue.

If, however, the gingivopericementitis also involves the surrounding bone, and all of

the surrounding area becomes pus-soaked, we call such a condition gingivoosteopericementitis, and the prognosis in such a condition is unfavorable. We always advise the removal of the teeth undergoing a gingivoosteopericementitis. It is important therefore to differentiate as to the amount of tissue that is destroyed, and to be able to differentiate a gingivitis from a gingivoosteopericementitis.

Dentists who give much thought to so-called "pyorrhea" should remember that in the proper treatment of a gingivitis the prognosis is usually favorable. By obliterating the hypertrophied gum tissue and a thorough prophylaxis it is possible in a large number of cases to obtain a favorable prognosis in gingivopericementitis.

There is no favorable prognosis in gingivopericementitis except complete removal of the teeth.

Dr. Jos. D. Eby, New York City.—During the past year Dr. Bast's work attracted my interest in the form of one or two beautifully illustrated articles in which I saw that he was following a study of bone along those physiologic lines upon which the science of orthodontia is founded, not to refer to other very important phases of dental science.

Although a stranger to Dr. Bast, I took the liberty of writing to him and asking certain questions concerning the behavior of bone in the processes of construction or repair based on his findings and applied to such conditions of interest to us as the solidification of fractures and grafts, regrowth of bone following root resections, cysts, etc., and the movement of teeth as the result of suggestive stimulation. I also questioned the Doctor closely as to whether new bone under such conditions passes through transitional periods of development before it became thoroughly seasoned and well-nourished tissue, and asked for his opinion on this moot subject which appears before us frequently under the name of sclerotic bone.

Dr. Bast's replies were so very interesting that it was felt that his paper would be a valuable acquisition to our program, as it has proved to be today. It is, indeed, a very fine control for orthodontists to study and think of the physiological aspect of his work, which will tend to deepen his insight and correct his ever-growing tendency towards the morbid mechanical side of the question into which he may become so easily trapped. I have come to sit and learn from a master hand, not to enter into this discussion, because the subject is so valuable and so distinct that in discussing it there is the danger of drifting from the essence of the thought thereby destroying the true value which should be carefully retained in our minds.

In all applied sciences or in clinical procedure, the operator is largely dependent upon, and sometimes seriously limited by, the results of the investigations of such laboratory scientists as Dr. Bast, who have the facilities, knowledge, time and persuasion to reveal in minute detail the natural conditions by which we must be guided.

There is nothing more beautiful in the entire study of tissue than the phenomena of bone, not only in its development and growth, but also in the varied processes of maintenance and repair. Nothing should content the orthodontist more than to study bone constantly, to cut and section maxillae and mandibles, etc., until he has developed within himself a perfect knowledge of this great substructure within his field of action.

For the great ranges of density in bone to be found throughout the skeleton, I have enjoyed the analogous thought that the bone cell is the workman and with the inorganic salts provided as the material, he plies away at the task of meeting the demands of the immediate locality and according to definite specifications.

If he is well-nourished and lives in good environs then he is a healthy workman, and if he has delivered to him good lime and phosphorus, he builds a fine structure which is easily repaired, but if he is sickly and weak, has enemies around him, or has poor "clay" with which to "mould," he falters in his task.

The results of this workman are a common daily sight to most of us, but Dr. Bast has given us the privilege of seeing him in his private life so to speak, he has taken us to his home, has shown us some sidelights on his character and greatest of all, has shown us how he propagates in kind for youth to replace the aged in accomplishing the ceaseless duties which must be carried on.

In the maxillae and mandible, every gradation of bone to be found in the entire

skeleton is represented in densities varying from the dense subperiosteal and cortical substances to the most delicate cancellous formations arranged to meet the most exacting specifications of teeth, muscles and many other surrounding influences.

With all of the physiologic provisions and the countless pathologic heritages it is little wonder that the uninformed dental radiographer is a modern Columbus, but if we more fully realize how sensitive this workman, the bone cell, is to respond here and there to suggestions, there is little to wonder about in all of the things they discover.

The solution of our problems is to be so familiar with this workman as to assist him in his duties and not to destroy him by the oppression of our ignorant abuses. I believe that the practice of orthodontia today is in perfect accord with the beliefs of Dr. Bast. I consider that Dr. Bast's paper will prove to be one of the classics of this meeting and in behalf of the members I wish to thank him for the lovely manner in which he responded to our invitation.

Dr. Theodore H. Bast, Madison, Wis. (*closing*).—I am not able to answer that question at present.

Regarding the question of the maxillary bone and other bones of the skull, apparently growth takes places in a different manner from that either in the membrane bones or cartilage bones that have been described. We know that in the growth of the mandible and maxilla there is a forward growth. It does not grow as do the long bones from the epiphyseal line, but we have growth at the end, and that has not been carefully investigated from an anatomical standpoint.

Dr. Jordan of the University of Virginia has done more work on the growth of the maxilla and the mandible than any one anatomist that I know of, but he himself has not reached any definite conclusions as yet.

We know that where there is pressure on a bone there will at first be absorption. You can have an aneurysm and absorption may go on rapidly. If you have a case in which the mandible is involved, where external growth takes place rapidly, the growth may take place on the opposite side. I do not know whether that explains the point you are trying to get at or not. How do you treat your case with appliances?

Dr. Eby.— Usually by the application of stimulating force, moving the teeth outward and the bone is absorbed buccally and ultimately is absorbed on the side where pressure is applied.

Dr. Bast.—It is natural that bone will absorb where pressure is applied. You can get an aneurysm along the spine and the bone is absorbed where the aneurysm takes place. Pressure even of the soft structures of the blood vessel will remove bone and excessive thickening takes place in the opposite directions from where absorption takes place. How bone is laid down in such a case is not definitely known.

I have a microphotograph of the petrous portion of the temporal bone in which ossification took place entirely different from the ossification in ordinary bones. Dense cartilage seems to be laid down, and then excavation takes place by means of osteogenetic buds, new bone is formed around the osteogenetic bud around the excavation, but the large masses of cartilage lying between these new bone formations begin to calcify. This calcification takes place around the individual cartilage cells.

I cannot speak on the question of the maxilla and the mandible at present. It needs to be studied further, but I was thinking whether or not the type of growth which takes place in the petrous bone associated with these bones of the jaw would have some bearing on the growth as it takes place in the maxilla and mandible. I cannot give you any definite information on the question you have asked.

Dr. Harold Chapman, London, England.—I noticed that Dr. Bast in his paper showed no muscle attachment to the ilium at all and to the other bones, and where there was muscle attachment the growth was considerable. I would like to ask the essayist if he can tell us whether the muscle action has any marked effect in producing cell division he referred to and whether he has investigated the matter from the point of view of diet and of muscle function.

Dr. Bast.—Bone has not been investigated from the point of view of diet. Muscle attachment does not have any influence on cell division because I can show all kinds of bone cell division in ethmoid bones in man, dogs and rabbits to which muscles are never attached. Cell division takes place in all these bones. The ethmoid of dogs first attracted my attention to cell division and this bone certainly has no muscle attachment.

In closing, I shall venture a functional conception derived from these structures. If the bone cell is active, as the structural facts indicate, then I believe that the bone cell is concerned in the regeneration of bone. The bone cell bordering the injury becomes active and gives rise to new bone. Of course, the deeper cells of the periosteum can do so also, but only as they are in contact with other bone. In case of bone wounds the cells which border the wound can easily be destroyed, and thus it often happens that regeneration does not occur unless the old surfaces are scraped and other bone grafted there. These bone cells are easily destroyed by suppurative processes.

I have just begun a series of experiments which I hope will give some positive evidence on this question. As far as I have gone only negative evidence has been obtained. I operated on young rats, removing a small piece of the parietal bone, or in several cases making only a cut in the bone. In all of these cases I used no aseptic precautions. Suppurative processes set in in all cases. Within a week the wound healed and suppuration subsided. Several days after the operation, while the pus was still present, subperiosteal tissue had grown all over the wound. Three weeks after the operation the subperiosteal tissue was still present, but not a sign of bone. The bone bordering the wound was covered by a callus-like formation. The question arises why did not this new periosteum form new bone?

TWO CASES FROM THE HARVARD CLINIC*

By Lawrence W. Baker, D.M.D., Boston, Mass.

IN the absence of Dr. Baker, the following report was read by Dr. Horace L. Howe:

As much as I would like to be with you and present to you my message personally, I greatly regret unforeseen circumstances make it impossible for me to do so. However, my friend and coworker, Dr. Howe, is with you, and he has been kind enough to consent to present to you the most interesting part of my contribution to the meeting, which consists of a series of slides, illustrating two cases I regard worthy of your attention.

I have observed that the most active and progressive minds of our specialty are always interested in orthodontic education. They are always concerned in the training of those who are to enter our ranks. I, therefore, believe the two cases selected from the larger group, I hoped to present, will interest you most, for they are the work of students. They are the work of undergraduates in the orthodontic clinic of the Harvard Dental School. These cases not only show what the students did under instruction, but furthermore show what Nature did with these same results years after the removal of all appliances, both cases having been treated ten years or more ago.

The first case entered the clinic in 1912. He was a student in the academic department, and realizing he had a deformity that was increasing with alarming rapidity, he sought relief at our school clinic. The original

*Read before the American Society of Orthodontists, Chicago, Illinois, April, 1922.

condition is shown in Fig. 1. In two working school years—from October to June—the conditions shown in Fig. 2 were brought about. (The first year, the case was in charge of instructor, Dr. W. H. Gilpatric.) You will

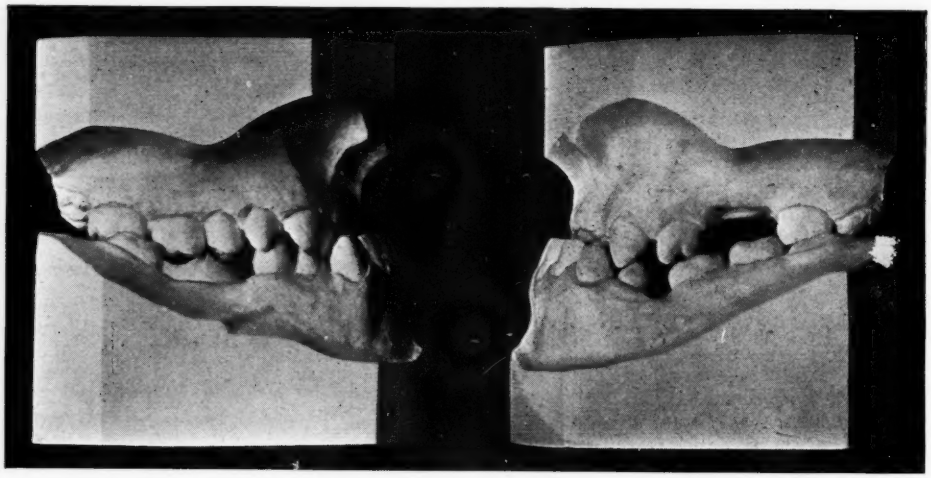

Fig. 1.

Fig. 2.

Fig. 3.

also observe the skillfully constructed crowns and bridges, the product of students' work in the Crown and Bridge Department.

Fig. 3 shows the conditions as they are today. In fact, the slide was made especially for this occasion.

The second case which Dr. Howe is to present for me is that of a boy. Treatment was begun in 1908, when he was twelve years old.

Fig. 4 shows the original condition before treatment, fourteen years ago.

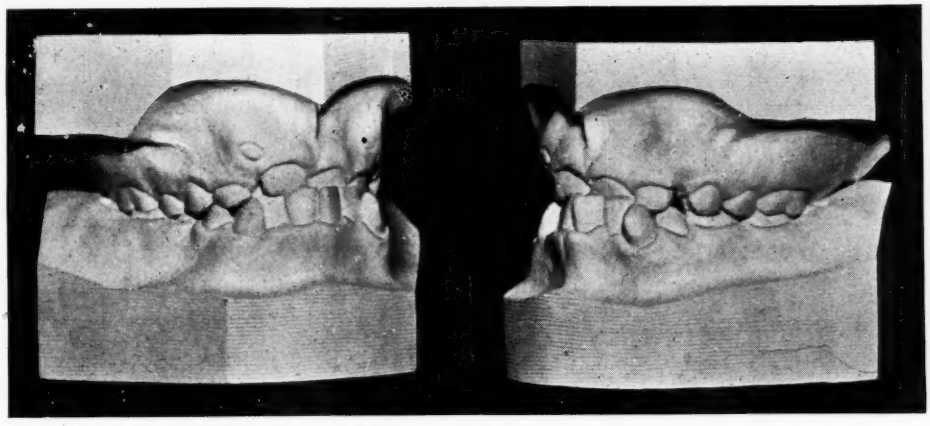

Fig. 4.

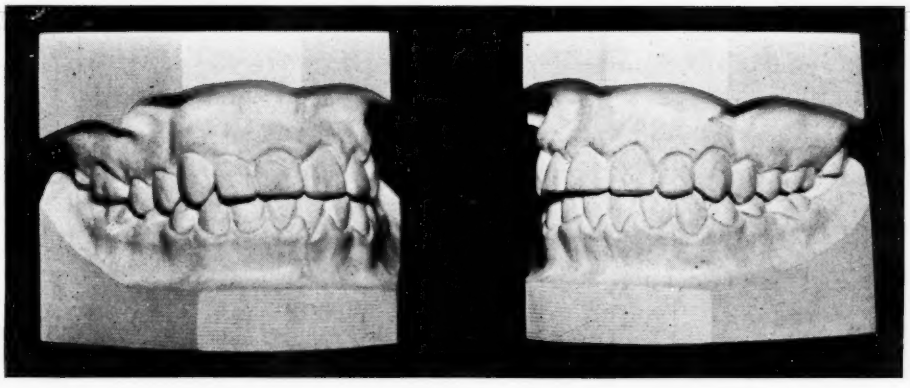

Fig. 5.

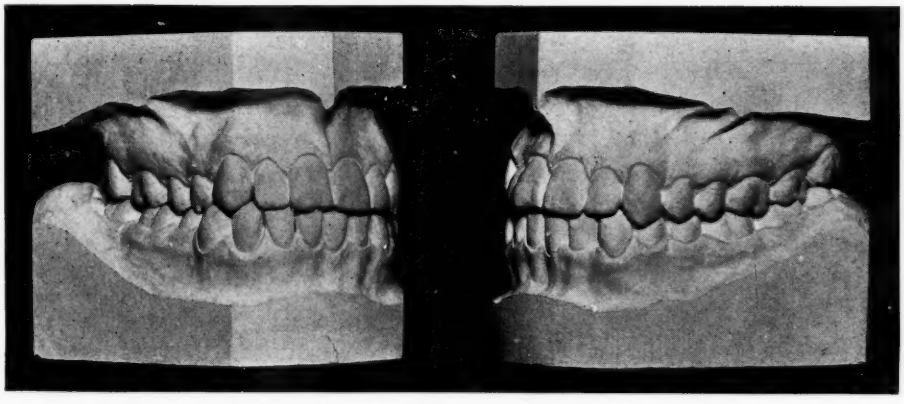

Fig. 6.

It will be observed, that among other things, the maxillary left canine is completely impacted, while the right canine is erupting over the distal corner of the right central.

Fig. 5 shows the condition after two school years of treatment. Although this is students' work, nevertheless it is no exaggeration to term it an orthodontic triumph.

Fig. 6 shows the conditions as they are today—twelve years after the completion of active treatment. You will observe that not only is the case holding well, but if anything, conditions have improved. Observe the fine bone growth.

It is worthy of note that both these patients are making their place in the world. The first young man is a music critic for the Boston press. The second, a graduate of the Massachusetts Institute of Technology, was engaged in railroad engineering for a number of years in South America, and recently has become an officer in the United States Navy.

What would have been the career of these unfortunate dental cripples without orthodontic aid?

DEPARTMENT OF ORTHODONTIC TECHNIC

Edited By
H. C. Pollock, D.D.S., St. Louis, Mo.

ELEMENTARY ORTHODONTIC TECHNIC

Materials for Plain Molar Bands

By H. C. Pollock, D.D.S., St. Louis, Mo.

(Continued from February issue.)

It seems unfortunate that up to the present time band materials have not been standardized and there is a wide variation in these materials in use in various parts of the country and in various offices. There is still contention, obviously, as to the relative merits of various materials; however, Herbert Pullen has pointed out four characteristics which he believes to be essential to a satisfactory band material: first, high fusing point; second, noncorrosive and nonoxidizing; third, good edge strength; and fourth, capable of being easily burnished to the teeth. Pullen claims:

"1. *High Fusing Point.*—A high fusing point is needed to secure safety in soldering operations. Many of the samples of band material which have been placed on the market have been of a low fusing point, and this band material would often fuse before the solder, thus ruining the band. However, the best known manufacturers now furnish gold and platinum band material of a high fusing point.

"2. *Noncorrosive Materials.*—The use of the highly corroding and oxidizing German silver band material is on the wane, although there is still a large amount of this material used by those who do not understand the handicap they are under in its use. Gold and platinum band material will not corrode and will not oxidize unless too much base metal is alloyed with it.

"3. *Edge Strength.*—Edge strength is important and without it band material will continually bend instead of holding its shape while being forced between the teeth. Gold and platinum, with a small percentage of silver and copper to give hardness, produce a band material of splendid edge strength.

"4. *Burnishing Qualities.*—A band material which does not readily burnish to the teeth will spring away and will never perfectly fit the circumference of the molar. It is possible to obtain this quality combined with good edge strength in the best band material."

There is an old epigram, something about the foundation of a house built upon the sand will be a disappointment to its builder. So it is with molar bands for an orthodontic appliance. Like unto the house built upon the shifting sands, these bands are the very foundation of a fixed orthodontic appliance. If they are not strong, durable, and at the same time, well fitted, an orthodontic appliance cannot be efficient, regardless of how beautiful a piece of jewelry it may be, for the reason that it has no foundation to build upon, and an efficient appliance must have a good basic foundation.

In addition to the qualities as pointed out by Pullen, in choosing a material for use as molar bands, then, it must first be strong, tough, and durable, be able to withstand the chemical action of the saliva of the mouth, as well as the various stresses which will be placed upon it, particularly the stress of mastication and occlusion, as well as the mechanical stress exerted by the appliance. For convenience, materials for the above purposes are divided under two headings, namely, "Base Metals" and "Precious Metals," by most authors.

BASE METALS

German Silver or Nickel Silver.—German silver is a material which, in the past, has been extensively used, however, not so much used as a molar band material in modern orthodontia on account of its susceptibility to corrosion in the mouth and its consequent short duration of service. This material does not resist the action of saliva well, soon pits, and perforations appear. Its use and duration of service in the mouth can be extended only by using the band material so thick that it requires a long period of time for chemical reactions to break it down. Various alloys of nickel have appeared from time to time, but there seems to be serious objection to all of them. Some manufacturers have placed upon the market, and caused to be used in considerable quantities, base metals for orthodontic purposes that metallurgical analysis has shown to be nothing more or less than brass with a new name and it is needless to point out that such materials should be avoided carefully.

There have been used some base metals which resist the action of saliva successfully, but insofar as the writer is aware they have never been placed upon the market, and are difficult to secure. Nickel silver has the added advantage, as has been pointed out in the past, of its resistance to the action of bacteria; however, the day of ordinary nickel silver as a molar band material is past, or at least is passing at this time, inasmuch as it is obvious the percentage of orthodontists using nickel silver for the above purpose at this time is small.

PRECIOUS METALS

Coin gold as supplied by various manufacturers has enjoyed wide popularity as a molar band material. It holds its color well, is easily worked, resists corrosion and oxidation, and cements satisfactorily. In addition to the above, coin gold holds tenaciously to the tooth over a long period of time. Probably its two most serious defects are: First, it does not possess the strength exhibited by some precious metal alloys. Second, it does not resist

the action of bacteria in the mouth. Notwithstanding this, coin gold has enjoyed wide popularity among operators, in use as a molar band material for anchorage purposes. Its edge strength is hardly sufficient, however, as the constant stress of mastication seems to soon fold over, or wear its edge. Coin gold, nevertheless, is in demand as a molar band material at this time, and has been for a number of years.

Iridioplatinum is a molar band material approved by many operators. It is used in alloys of five to twenty per cent iridium with platinum and is a fairly satisfactory material to be used for molar bands; notwithstanding, contact points and approximating surfaces must be given most thorough prophylactic care where iridioplatinum comes in apposition to them. Iridioplatinum has no germicidal action, does not oxidize or corrode in the mouth, is expensive, but more economical in the long run than are many base metals.

Numerous iridium alloys of fine gold are used with equal success, and are being sold by various dealers in orthodontic supplies. Directions for thickness of band materials for molar bands cannot be given without a knowledge of the alloy of the material, inasmuch as a very small variation in iridium content changes the rigidity and elasticity of a band material considerably. Suffice it to say that a band material should be sufficiently rigid and stiff for use as anchor bands, at the same time pliable enough that it may be burnished and fitted to the tooth.

Numerous alloys and combinations of precious metals may be procured from manufacturers, especially and carefully prepared for service as a molar band material. In working with orthodontic band materials, dimensions should always be given in thousandths of an inch. B. and S. gauge dimensions are not sufficiently accurate for measurement purposes in ordering these materials in which only a very slight variation of thickness so materially affects the working qualities of the material.

On the other hand, as regards the use of iridioplatinum for the purpose under consideration, I am entirely aware that it is criticized by some. To quote from Dewey, editorial from the *International Journal of Orthodontia*, October, 1921: "As regards noncorrosive and nonoxidizing, no band material exists which will not discolor in some mouths. We have seen iridioplatinum band material discolor in the mouths of patients, or at least some sort of deposit forms on the band material which is black. As regards edge strength we have said before that gold and platinum alloy does not possess sufficient edge strength and is far inferior as regards edge strength, to nickel silver and especially those band materials containing a high percentage of nickel. As regards the fourth requirement, any band material that can be easily burnished to the tooth is too soft to stand the stress of mastication. We admit that a band can be made out of materials that burnish to the tooth, but after six or eight months of use in the mouth, subject to the various stresses of mastication we find the band in a decidedly unsatisfactory condition."

To quote from this editorial further: "As regards the statement that a band can be perfectly fitted and contoured, that is only a question of judgment, because we do not believe it is possible to ever 'perfectly' fit a band.

We believe a band material should be sufficiently rigid to make burnishing and contouring difficult, and the band can only be accurately fitted by the employment of a certain amount of skill and technical ability which comes only as a result of giving careful attention to detail. Any band material which is softer or which can be in contour more easily than iridioplatinum is too soft.''

A band material may be entirely too stiff and rigid. It may be so rigid that it may not be adapted to the tooth closely, perhaps having a tendency to spring away therefrom, in which event the space thus left between the band and the tooth is filled with cement when the band is set to place. This space thus created makes a most convenient spot for the accumulation of food debris and incidental decalcification of tooth structure after the cement has washed out during use, and should be watched closely.

On the other hand, it is quite easy to choose a molar band material which is too soft and pliable. Such materials tear easily and do not withstand the general wear and tear incident to stress of occlusion and mastication of food. Molar band material should be chosen with care and caution, and it is to be remembered that all band materials are not good band materials for orthodontic purposes. One good quality which is much in favor of an anchor band is that when placed on the tooth it goes to place with a snap, just like it belonged there. If the material possesses the required amount of rigidity, the gingival edge may be crimped in such a manner that when placed upon the tooth it grips, or ''takes hold'' slightly.

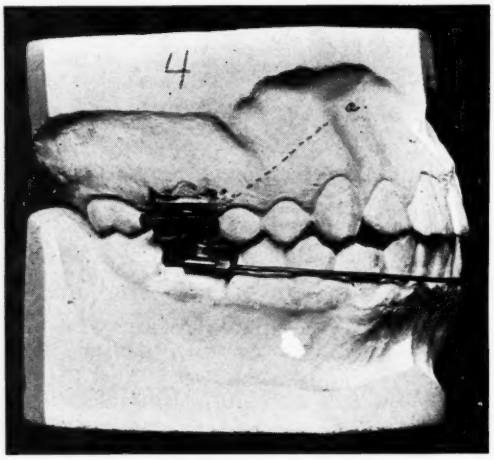

Fig. 1.—*A* illustrates soldered attachment of buccal tube to plain molar band. Molar band must be of ample strength to resist the stress of mastication.

Buccal tube *A* may be shifted in its relative position from time to time by fusing the solder by which it is attached to the molar bands.

If plain bands are too liberally festooned, it is difficult to secure this grip of a band to the tooth as referred to above; also if material is used which bends with a dead bend, it is impossible to secure a grip of the band to the tooth above mentioned.

Band material must have sufficient strength to support easily the soldered attachment of either the buccal tube (Fig. 1-*A*) or of any other soldered attachments which may be desired on the finished appliance. It must be strong enough that the soldered attachment will not tear out of the band.

Fig. 1 also illustrates the relative position of the buccal tube to the plain band; also indicates the manner in which the buccal tube may be shifted in its relative position by fusing the solder in order to conform and be parallel to the occlusal direction and be placed in its proper position in relation to the labial arch wire. Buccal tubes must be parallel to, and in the same plane with, the labial arch wire.

(*To be continued.*)

DEPARTMENT OF
ORAL SURGERY AND SURGICAL ORTHODONTIA

THE LAWS OF LEVERAGE GOVERNING SPLINT WORK OF THE VARIOUS FRACTURES OF THE BONES OF THE FACE AND HEAD*

By Grover C. Smith, D.D.S., St. Louis, Mo.

As the subject of this paper is very new and as we are still in that unpastured field of hope, there is as much room for criticism as for compliments. In one of the cases shown here tonight, perhaps the only one of its kind in the world, the mandible was cut in three places to correct a malformed face, which was performed by the master hand of my surgical colleague, to whom I am so much indebted for the encouragement I have received in the progress of this work.

Referring to the fractures of the bones of the face and head, we learn from the divine scripture that the second man born in the world was slain by a blow on the head, which undoubtedly meant a cranial fracture.

The various forms of fractures are so numerous that it would be impossible for me to include them in this paper, and I will ask that the simple classifications of the text book be kept in mind as I explain some cases.

By the word "fracture" we mean a broken bone regardless of classification, and the first thing that comes to our mind when the word fracture is used, is the question of the kind of splint that will be required, for splints are necessary in almost all forms of fractures regardless of their nature.

Splints are not so old as, or known to men so long as, fractures; however, back in the year 1012 B.C., that faithful old king of Tyre who sent one hundred thousand men to help King Solomon in his great work, took precaution to make splints from the choicest timber of Mt. Clemmons for the fractures his men might receive at their labor.

This paper will only deal with fractures where bone grafting is neces-

*Read before the December, 1922, meeting of the St. Louis Dental Society.

sary and where cast splints and noble metals are used in accordance with the laws of leverage from a mechanical standpoint.

In cases of bone grafting you will readily see that a space exists between the ends of the bones from sloughing, or where the bone is cut in two and the space created for the purpose of making a bone longer where no other repair could be made that would bring about a normal condition. Both cases will be shown here tonight and perhaps fully explained by Dr. Coughlin.

Fig. 1.—Case No. 1, showing a second class lever used for a faciocranial fracture.

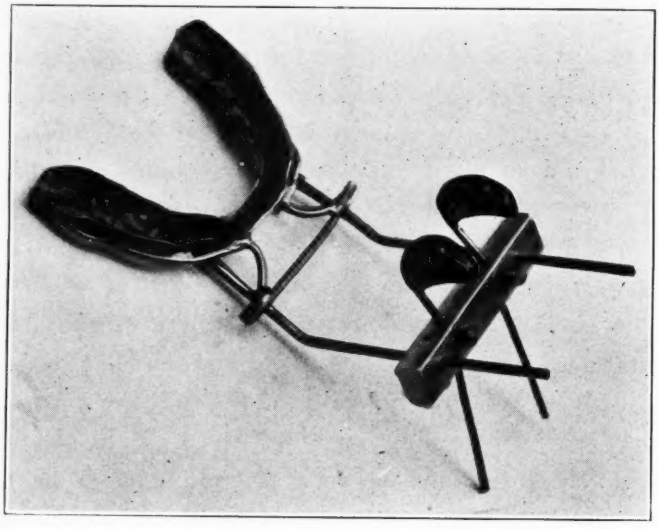

Fig. 2.—Showing a third class lever, where the teeth are used for the retention of the splint.

The purpose of a splint is to act as a lever against the muscles that pull the broken ends of the bone out of alignment and must be made and applied so that it will create the proper balance in any one of the three levers which may be used and the law is as follows.

A bar of metal, wood, or other substance turning on a support called the fulcrum and used to overcome a certain resistance (called the weight), encountered at one part of the bar by means of a force (called the power), applied at another part. It is one of the mechanical powers, and is of three

kinds, viz.: First, when the fulcrum is between the weight and the power, as in the hand spike, crowbar, etc. In this case the parts of the lever on each side of the fulcrum are called the arms, and these arms may either be equal, as in the balance, or unequal as in the steel yard. Second, when the weight is between the power and the fulcrum, as in the rowing boat where the fulcrum is the water. Third, when the power is between the weight and the fulcrum as in raising a ladder from the ground by applying the hands to one of the lower rounds, the fulcrum in this case being the foot of the ladder. The law which holds in the lever is: the power multiplied by its arm is equal to the weight by its arm. It is evident that when the power has a very large arm and the weight is a very small one, a very small power will overcome a great resistance. In the lever, as in all machines when a small force overcomes a great one, the small force acts through a much greater distance than

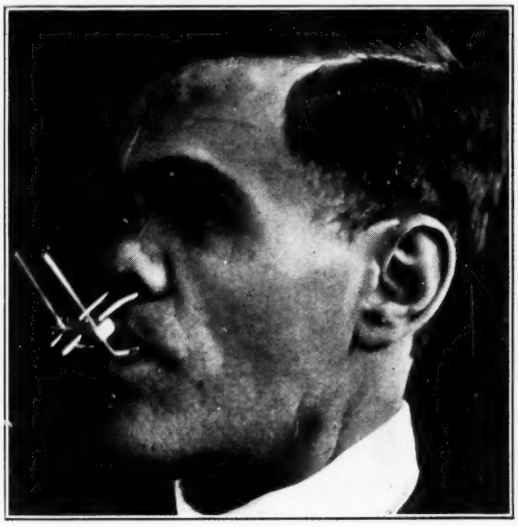

Fig. 3.—Showing a third class lever, where the splint is to be used for the reconstruction of a nose, showing the cartilage planted beneath the skin on the forehead and the flap cut on the neck.

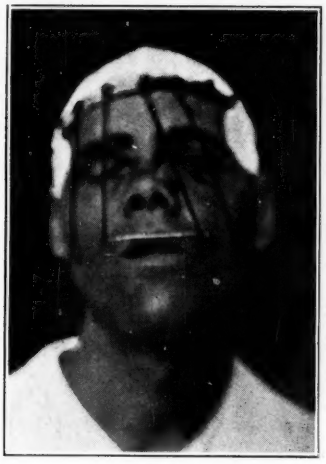

Fig. 4.—Showing a second class lever in place, for a faciocranial fracture, the splint is cemented to the upper teeth for retention.

that through which the great force is overcome, or as is sometimes said, "what is gained in power is lost in time."

Taking impressions of fractures for the construction of splints is very difficult, it is painful and very hard on the patient, plaster of paris cannot be used. Among all the different materials I have tried, I find modeling compound the best. Always take two impressions, one for the study model which is very important. Models must be made of hard material such as Spence metal or compound. In cases of mandibular fractures have the radiograph properly placed in front of you to see the line of fracture and mark the study model as accurately as you can; cut the model in two with a saw; do not use a knife or attempt to break it; place the teeth in proper occlusion and fix permanently on articulators.

The casting technic is very simple. Remember you must cast, for swedge splints are of no value. A $\frac{1}{1000}$ tin foil should be used over the model before carving the wax pattern for the splint. I am not going to dwell on the

casting technic for it is being taught in the St. Louis Study Club, the largest and best of its kind in the world.

The upper teeth are the retention form in nearly all cases of bone grafting in the mandible. After the splint is properly cemented to the upper teeth and small hooks made of clasp wire soldered to the splint and turned upward for the attachment of wire or ligature, the surgeon can apply as much pressure as he wishes with perfect safety.

Splints must always be made of noble metal, because they are in the mouth for a long time and as a rule it is hard for the nurse or patient to keep them clean; base metals are not tolerable to the tissues of the mouth and as a rule will keep the mouth sore with an ugly metalic taste which causes the patient to complain and irritates the surgeon very much.

We have no text books on splint work for bone grafting that are of any value for the latest modern surgery, and those that I have found showed no proof of their success for which I humble to your criticism on my work shown here tonight.

In the case of faciocranial fractures according to your text book classification, generally an eye is lost and the nasal bones destroyed, the upper part of the face drops almost one inch and it would be impossible for the bones to unite unless the upper part of the face were drawn up to its proper place with a splint. A cap is made of strong canvas to fit the head after it has been shaved, extended down to one-half inch above the eyebrow and well down on the back of the neck where it is fastened with adhesive tape. Small hooks are sewed on the edge of the cap in the front and on the sides as far back as the ear. A splint is cast for the upper teeth; a platinoid bar is soldered on either side of the splint from the first molar to the lateral incisor on either side. The bar is bent outward about one inch and then back so that it would extend to the lobe of the ear and about one-half inch out from the cheek. This bar can be made of the ovoid type to give it strength. Small notches are cut in the bar for the purpose of holding the elastic ligatures which are looped around it and placed on the hook sewed on the cap. From this time on you will receive instructions from the surgeon in regard to the amount of pressure he wants applied.

In cases where the surgeon wants the mouth propped open for either a mandibular or faciocranial fracture, take a thirty-gauge gold plate and cut it similar to the open bite and solder the narrow or posterior ends together. Prop the mouth open with any of the ordinary mouth props as wide as you can on the opposite side from which you are working. Fit the gold form in the mouth over the teeth. Take any of the high grade alloys to fill the gold form and place in the mouth, removing the prop on the opposite side, and the patient can close into the soft alloy which can be burnished around the teeth and left about two hours before removing it. Give it about thirty hours to crystallize and it may be used as a prop for making the splint on the opposite side. After the splints are polished and just before they are put into the mouth a thin layer of cement can be put into the lower part of the splint which will hold it in position as long as necessary.

Referring to the fractures shown where bone grafting was necessary, the case will be known as a double mandibular fracture about the first premolar region on either side. The patient received the injury about three years ago and received surgical treatment for about two years, other than our service, during which time the bone sloughed on either side from the cuspid to the second molar region. About November 21, 1921, he was referred to our service from his home in the southern part of this state. The splint used at that time was contrary to the laws of leverage and perhaps is the cause of the failure of the previous operation. The posterior fragments were turned over so that the buccal side of the teeth was horizontal with the dorsum of the tongue, the anterior fragment was drawn down by the suprahyoid group of muscles, the incisal angle of the teeth was protruding labially. In cases of this kind the upper teeth are used for attachment for a splint. A splint was cast for the upper teeth with a thirty-gauge clasp wire soldered to the buccal side, leaving little loops for the attachment of ligatures and cemented to place. The lower splint was cast in three pieces for the three fragments and cemented to place with hook attachment; the jaws were drawn up into proper alignment and wired tightly to the upper splint, giving the face a normal profile. The surgeon removed enough bone from the lower leg to fill in these two spaces.

This patient was discharged from our service sometime in May, 1922, and I am proud to say that I had the pleasure of discussing Dr. Coughlin's paper on September 27 last when he showed the case to the St. Louis Medical Society, as a well man; and for the benefit of the dental profession he has come up from the southern part of this state for your inspection tonight.

In the beginning of this paper I mentioned a case where the mandible was cut in four pieces on account of its deformity, and when I was called upon by Dr. Coughlin to cast the splints for this operation it gave me a greater shock than when I sat upon the back of a mule that let his body lean out over the precipice of the cliff four thousand five hundred feet high, to pick a blade of grass on the wall of the Grand Canyon; however, it gives me as great a thrill to show this patient tonight almost well. One more operation which will be explained later and the patient will be brought from that isolated field of discard to the smiling ranks of society.

Splints were cast for the upper and lower teeth, the upper were cemented to place and the lower cut in three places, at the symphysis and the second premolar region on either side; my surgical colleague cut the mandible at these three places and in the third molar region on either side. The fragments were drawn up and wired to the upper splint. Union has now taken place in the posterior fragment, and the ends of the anterior fragments are spread apart at the symphysis about one inch and held in this position with the splint. When the bone graft is made there to extend the mandible for the proper formation of the chin, the operation will be completed. It will be the first of its kind on the pages of history, and the only one known in the world of today.

REPLANTATION OF TEETH

The conclusion of this paper will be on Replantation of the Teeth.

A few years ago when the 100 per cent vitality race was on, I was not far behind the leader, but one day about five years ago while extracting a lower left first molar of a boy about fifteen years old my elevator worked backwards and threw the second premolar out on the floor. In my excitement looking for the tooth I stepped upon it. The pressure caused it to shoot out into the room among the patients. After a considerable amount of embarrassment the tooth was retrieved and the battle began. I opened the tooth, removed the nerve, burned it out with sulphuric acid, neutralized it, used the silver nitrate treatment, filled the canal and perhaps several other things that I cannot remember now before getting the tooth back into the mouth, still having enough thinking power left to give the patient an appointment for about three weeks later to be sure that I would not hear his trouble; but to my surprise he came in at the appointed time with a smile on his face, the tooth reasonably solid and feeling fine, and a recent radiogram shows the tooth normal today. It immediately caused the ultra-conservative part of my conscience to throw a monkey wrench into the machinery of my 100 per cent vitality system. It encouraged me to try it on some of the devitalized teeth I had been throwing away after extraction, so I began to inquire among the older men of the profession for an operative procedure. I was told by one of the deans of one of our universities that the operation was no good, that it was tried twenty-five years ago by some great and famous man away out west and failed. That was all he knew about it, others in the older class gave me the same story, but thanks to Dr. L. R. Main who had replanted some teeth and gave me his technic which helped me very much, I have now over one hundred cases to my credit with about 10 per cent of failures.

The operation is very simple. I have placed the age limit for the operation at thirty-five years and the most of my failures were about that age and over. I replant only single-rooted teeth. After the tooth is removed from the mouth cut the dead end off with a disk and polish it; I mean by the dead end that part of the root which is covered with a pus sac. Use any of the modern canal filling material for filling the root before replanting. If the granuloma does not come out with the tooth when extracted, use a very small curette to remove it, being very careful not to cut the wall of the alveolus. I find the operation more successful with nitrous oxide than with local anesthesia, for with nitrous oxide you get a better blood clot for replanting the tooth. The retention form is ligaturing to the adjacent teeth, using the Cannings bands for attachment which are cemented to the teeth to prevent the ligature from slipping. Remember asepsis is the most important factor of the operation, careful sterilization of the alveolus and tooth before replanting is the secret of the operation. Put a small amount of scarlet red salve on the apical end of the tooth just before putting it back into place. The tooth can be kept out of the mouth for a period of one hour with perfect safety, but should be kept in a normal saline solution as much as possible while out of the mouth. Do not depend upon the patient to take care of the

tooth; see him every day and be sure that the proper kind and amount of antiseptic is used.

Watch the ligatures very carefully so that they do not pull the tooth out of its proper position. It requires from ten to fourteen days for the tooth to become firm enough to remove its retention form.

After a period of about three months the tooth can be ground down and crowned or used as an abutment for a bridge, if necessary. Fig. ?? shows a case which was replanted about three years ago and used for an abutment for a bridge and is very firm in the jaw today.

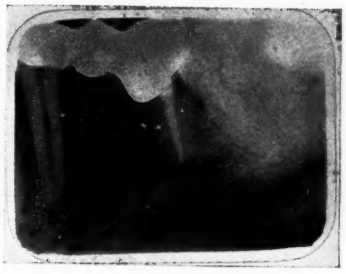

Fig. 5.—Showing a replanted tooth, an abutment for a bridge which has been giving service for three years. A recent radiogram showed it to be in good condition.

It is impossible for me to give a prognosis in this work. I have several cases that I have replanted at different times in the past five years and a recent clinical examination shows them to be very firm and the gum condition to be normal.

This operation is only indicated where teeth have been devitalized and have become infected, and extraction is the only recourse. I contend that a replanted tooth, if the radiogram shows it free from infection, is far superior to any bridge work or other restoration which may be used, especially, in the mouths of young girls where esthetics are such an important factor.

CANCER OF THE MOUTH AND JAWS

By Vilray P. Blair, M.D., F.A.C.S., and Morris J. Moskourtz, M.D.,
St. Louis, Mo.

THE dentist occupies a singularly important position in the war being waged upon cancer of the face and mouth. In a series of one hundred and sixty cases of undoubted cancer about the mouth and tongue Bloodgood found thirty-three patients or approximately 20 per cent who had consulted dentists for extractions or other kind of dental work without having had their malignant lesions recognized. Delay in proper treatment after the onset of the malignant condition, according to the same observer, reduces the chances of cure in operable cases from 62 to 12 per cent and increases the chances of postoperative death from 5 to 30 per cent. Further delay means an inoperable condition for which at present we have no treatment that promises anything.

The "cancer age" coincides with the period of life when the teeth are most likely to demand attention, and whether or not the dentist has a knowledge of the symptoms and the methods of diagnosis of malignant diseases and a familiarity with the accepted means of treatment of these conditions, will determine whether he is in a position not only to give the patient the best surgical advice, but also to judge as to whether the treatment is being properly carried out. Even if he knows only that certain conditions are apt to be precursors of cancer, he can so advise the patient and urge him to place himself under the care of a competent observer. In a recent discussion Gilmer says, "Ever since I have come in contact with dental students as a teacher, I have emphasized the importance of a better knowledge of mouth, face and jaw pathology. I have tried to impress students with the fact that they are responsible to their patients, not only for the condition of their teeth and gums, but as well for the whole of that part of the anatomy they are supposed to care for." If dentists can be impressed with the importance of rapidly but thoroughly observing all the exposed mucous membranes in the course of an examination of the teeth, they will be repeatedly rewarded by the satisfaction of having given timely advice of life-saving value to many a patient. That the dentist's good advice is not always followed and that it is not always supported by the physician may be discouraging at the time, but this does not lessen its validity or in the long run its utility. The victim of such non-cooperation on the part of the medical man is going to later speak his mind forcibly and impress upon many the advisability of following the safer course.

Cancer of the mouth and jaws has been known for many centuries. In fact, Hippocrates recognized ulcerating cancer of the tongue and spoke of the value of the cautery when other methods would not cure. Galen believed

cancer due to black bile and this teaching held sway for many years, tending to check possible advancement in active treatment of the local condition. Celsus advised the cauterization or excision of ulcers that could not be cured otherwise. During the sixteenth and seventeenth centuries the cautery was used quite extensively. Wiseman mentions two cases of fungating cancer upon which he used the cautery. Vicary, the surgeon to Edward VI and Queens Mary and Elizabeth, mentions a large number of local remedies for "cancer of the mouth." Petrius Menonssta, a surgeon of reputation in the eighteenth century, cut away an ulcerous hardness which had recurred after a previous excision and applied the cautery. The patient was an old woman and the growth did not recur. In his surgery written in 1786, Benjamin Bell has a chapter devoted to ulcers of the mouth and tongue. He, too, concluded that the cautery was the last resort. Although a clear description of carcinoma of the tongue was given in the seventeenth century, it was not until the middle of the nineteenth century that a real differentiation from syphilis was made. It was the microscope that finally distinguished cancer from other simulating lesions of the mouth and tongue, and then chiefly through the efforts of Veribou, Rokitansky, and Sir James Paget.

A discussion of the various theories as to the specific cause of cancer would be entirely out of place in a paper of this sort. There are however, certain predisposing factors which are of great importance: (1) The age of the patient is usually between forty and sixty. Youth seems to be almost exempt from carcinoma about the mouth, and the condition is so rare before the age of thirty, according to Butlin, that the same statement might be made with regard to young adult life. After the age of thirty no one seems exempt, but by far the greatest number of cases will be found to occur between the ages given above.

2. Sex seems to be as striking a factor as age in predisposing to cancer. These conditions are many times more frequent in males than in females. Butlin's statistics on cancer of the tongue showed a predominance of nearly six males to one female, while for squamous cell carcinoma of the lip Broders gives the relative frequency as forty-nine to one. The common explanation of the great difference in the liability of the two sexes to carcinoma about the mouth has been the difference in the habits of men and women, the much greater frequency of smoking, strong drink and syphilis in the male sex, but it is seriously questioned whether any of these explains it.

Among the exciting causes of cancer about the mouth those usually mentioned are (1) irritation and damage produced by carious teeth and by badly fitting plate; (2) habitual smoking and the rubbing of the stem of a tobacco pipe on the surface of the tongue or lips; (3) the application of caustics to ulcers and other affections about the mouth; (4) syphilis. The reviewers are not so thoroughly convinced of the cancer producing rôle of trauma, although animal experimentation and clinical observations have shown that repeated trauma, including heat burns and certain chemicals, predispose to, or form, growths resembling cancer. Within the mouth the relation of a rough or dirty tooth to a cancerous ulcer is more often accidental than causa-

tive. Gilmer, too, feels that irritation is generally given greater prominence as a causative factor in the human mouth than is justified, unless the part irritated is in a leukoplakic path. Since there is so much irritation in the mouth which never becomes cancerous, and since careful observation often shows that the supposedly offending tooth, bridge or plate could not possibly have been in contact with the lesion in its incipiency, one is not to doubt if chronic irritation, when no leukoplakia is present, does play so important a rôle in causing mouth cancer as is supposed. Among the poor, women have many more defective, broken teeth than men, and they have less oral cancer. The frequency with which carcinoma arises upon the lower gingiva would suggest that the irritation of dental calculus might be a factor.

In reading the older literature especially, one gets the impression of the existence of a definite relationship in a very large percentage of cases between tobacco and carcinoma of the mouth. This does not seem to be borne out by Blair's clinical observation other than that most men use tobacco and it is, therefore, logical to suppose that most men having cancer of the mouth have used tobacco. The smoker's burn resulting from carrying a pipe or cigar in one particular place, or a history of having carried a wad of tobacco in a particular part of the mouth, are not infrequent precedents of cancer appearing at this site, but it has not been sufficiently common to warrant the conclusion that the causative relation of tobacco to cancer of the mouth is as specific as has been assumed. Concerning this point Butlin says, "There is no evidence with which I am acquainted which will prove that carcinoma is really much more common among adult males who smoke than among those who do not. If smoking causes sores, plaques or chronic superficial glossitis, it predisposes the individual in whom these conditions are produced to cancer, but if smoking causes no appreciable effect, it cannot be said to predispose to cancer."

The relation of syphilis to the etiology and diagnosis of malignant disease of the mouth is a most important one. Osler made the statement that the man who knows syphilis knows medicine, meaning, of course, that syphilis can ape almost any other form of disease. "There is scarcely any affection about the mouth and tongue," says Butlin, "in which the possibility of syphilis, hereditary or acquired, must not be considered. Yet nothing causes greater mistakes in diagnosis and treatment than the tendency to see syphilis in every form of obscure and not readily diagnosable condition of the mouth, or to persist in a diagnosis of syphilis even after a short and vigorous course of antiluetic treatment has been of no avail." The question of the influence of syphilis has often been raised. "In so far as syphilis is capable of producing ulcers and scars about the mouth, in so far is it capable to predisposing to the occurrence of cancer. But ulcers and scars produced by syphilis are not more prone to become cancerous than the ulcers and scars due to any other cause, nor is the chronic superficial inflammation produced by syphilis more apt to become cancer than a chronic superficial inflammation which has no connection with syphilis," says Spencer.

Treatment of early cancerous or precancerous lesions about the mouth

with irritants is even worse than a failure at diagnosis. Of the application of caustics to ulcers and other affections about the mouth, Butlin states emphatically, "If there be one thing more harmful than another in the treatment of simple indolent sores and affections of the tongue in persons over thirty years of age, it is the application of a strong caustic. The practice is one which cannot be too strongly protested against. They are not necessary and the good which they do is as nothing compared to the cruel harm which they have done to many tongues. So far as affections of the tongue are concerned, we should not be sorry if caustics were never again employed in the treatment of any of them."

Almost every modern writer who has touched upon the subject notes the fact that men who develop cancer about the mouth have been previously warned by definite local lesions which are not cancer. In this category may be placed warts, indolent ulcers, fissures and leukoplakia. Of all the actual beginnings of cancer, there is none nearly so important as a wart or warty growth, especially when this forms at a place which is already the seat of one of the dermic conditions which predisposes to cancer. "Not only," says Butlin, "is it the most frequent, by far, of all the conditions which pass directly into cancer, but it is probable that it never occurs on the surface of such tongues without becoming cancerous, if it is not removed or completely destroyed. It may, therefore, be considered not only as a *predisposing cause* of cancer but as an *actual precancerous* condition. These warts are usually single, but they may be multiple. On the lip one may secure a history of ulcer having disappeared at times and then returned. In most cases of the transformation of warts into cancerous growths, the increase in size, the ulceration, the greater firmness of the wart itself and the growing induration of its base are the principal characteristics by which the change is announced. It is safest to completely remove the wart first and consider the diagnosis afterward. One is amazed by the large number of inactive, apparently innocent warts about the mouth, which on microscopic examination show the biological characteristics of carcinoma. Butlin cites the case of a single wart about the size of a pea which had been removed from the tip of the tongue of an old man of eighty. It did not appear to penetrate beneath the surface of the mucous membrane and was thought clinically to be benign. On microscopic examination the changes typical of an early squamous cell carcinoma were found. A radical local excision was done and the patient lived for many years without experiencing any inconvenience.

The mouth is very prone to ulceration, nor is this to be wondered at when we think of the soft structure of the mucous membrane and the many sources of irritation and injury to which it is subjected. With the exception of syphilitic, gummatous ulcers, and perhaps of some or all of these which are tuberculous, practically all the ulcers about the oral cavity are primarily diseases of the mucous membrane. "This is true," says Butlin, "even of cancerous ulcers; in fact, the very vascularity and activity of the mucous membrane which serves in health to preserve its integrity and to restore it speed-

ily after slight injury are among the chief factors in the rapid spread of the ulceration."

The best classification of ulcers about the mouth is that which is based upon etiology. We then have cancerous, tuberculous, syphilitic and mercurial ulcers. The various other types which cannot be ascribed to a definite and clearly ascertainable cause, are usually grouped under the term "simple." These "simple" ulcers usually attack the run-down and debilitated. On the tongue they occur in all kinds of chronic superficial glossitis and occasionally in a scar. They form, according to Butlin, "Sometimes by the actual sloughing away of a fragment of the surface in the course of an acute attack of inflammation in the seat of old chronic inflammatory or scar tissue, but often are formed by a kind of melting away of the epithelium. The sore which is produced soon ceases to present an active appearance and settles down into a chronic ulcer, with a smooth red surface, inactive edges, not inflamed or indurated. Although it is so chronic it is often sensitive and may be painful especially when hot, spiced or irritating food is taken." The diagnosis of indolent ulcer is usually easy from its chronic course and lack of induration, as well as its association with chronic superficial glossitis. Such an ulcer may persist for many months with little change, but the safe rule is to regard all ulcerations about the mouth with suspicion, when present in persons who have reached the cancer age and not allow them to persist indefinitely. If within ten days to two weeks a definite diagnosis cannot be established, an examination should be made by a competent microscopist to rule out the possibility of cancer.

Leukoplakia is by far the most common local precedent of cancer of the mouth. Von Bergmann, in an analysis of 159 cases of cancer of the tongue found that over 50 per cent of them were preceded by this condition. The term leukoplakia means a white patch or opacity. The condition usually involves the tongue alone, but it is not at all unusual to find it on the inside of the cheeks and lips, the lower more often than the upper, and near the corner of the mouth. It may occur on the gums or palate, although rarely. On the tongue it occurs in two forms, which differ in appearance, in clinical course, and in pathology. In the first form the affected mucous membrane presents a smooth surface, free from papillae, of a bluish color, and the border of the patch may fade gradually into the surrounding mucous membrane or may have a sharp line of demarcation. The surrounding mucosa may or may not show evidence of irritation and there may be raw red patches within the bluish white area. The patch is usually pearly or opalescent and if removed, leaves a raw surface. The other form of leukoplakia appears as an opaque dead white or slightly bluish or yellowish patch, which is usually raised above the level of the surrounding mucous membrane, from which it is separated by a sharp line. It is thicker toward the middle than at the edges. The papillae, in this form, too, have disappeared, but the corneal layer is greatly thickened causing the raised white appearance. The condition is rarely seen in young people and about equally rarely in women, but it has been seen in women under twenty, in persons who do not smoke and in

those who are known not to be syphilitic. Hazen and Eichenlaub state that 70 per cent of the patients having leukoplakia are not syphilitic. Gilmer, on the other hand, has for years believed that the heavy opaque leukoplakia is like "Erb's" scar, a postsyphilitic lesion, a belief which is concurred in by other good clinical observers. None of the above, therefore, can be looked upon as the specific factor.

The subjective symptoms of leukoplakia are very slight unless the condition is well advanced. Butlin says, "Often there are absolutely no symptoms and the patient does not know that there is anything amiss until one day when he perceives the patch or patches when his attention has been called to it, especially if he has been told that leukoplakia may be the precursor of cancer, he begins to experience some distress, but it is usually more of mind than of body. In the more advanced cases a good deal of discomfort is experienced. The surface of the tongue feels harder and drier than naturally. The movements are not too readily or too smoothly performed, as they ought to be and there is great thirst. There is no actual pain even in eating unless there is some accidental inflammation of the tongue and salivation does not occur unless from the same cause. In most cases the diagnosis of leukoplakia is not very difficult. The very chronic course of the disease, its occurrence only in adults, and the character of the patches serve to distinguish it from diseases for which it is possible to mistake it. Thus the diagnosis from mucous patches rests upon the much more rapid formation and spread of the latter and the fact that the patches are usually dead white, while leukoplakia almost always has a bluish tint, unless stained by tobacco. Leukoplakia is a very chronic condition and may remain almost the same for many years, or it may spread extremely slowly over the surface of the tongue.

Patients should be told that there is little or no likelihood of cure without treatment in real cases of leukoplakia. Some of the early cases may clear up if the source of irritation be removed. The use of tobacco should be forbidden. Those that fail to clear up should be treated radically by excision. Antiluetic treatment is of no avail, especially if they show the slightest increase of induration about the base. The adoption of radical measures early will save the lives of many who would otherwise die of carcinoma of the tongue.

Naturally radium as a possible curative factor for leukoplakia has been in the mind of every one interested in this lesion and it has been tried in a great many cases. Freudenthal in 1906 first treated a case of extensive leukoplakia with radium. The ulceration and pain disappeared but the leukoplakia remained. Boggs and others report cases that have been improved or cured. Abbe thinks radium a positive cure for leukoplakia. MacKee, who has had an extensive experience with x-ray and radium in these conditions, has been disappointed with the results of both in the treatment of leukoplakia. He says x-ray was tried several years ago on a number of cases, but the results were so poor and the difficulty of proper application so great that the work was discontinued. During the past few years

efforts have been confined to radium. No improvement has resulted, unless the treatment has caused a reaction consisting of edema and erosion. Not a single extensive case of leukoplakia was cured, and since the lesion is exceptionally recalcitrant to all forms of treatment, the uncertain results of radium are all the more disappointing and discouraging. In a few instances the lesions disappeared only to return in a few weeks or months. Even some of the small lesions failed to disappear, and if they did disappear many of them recurred immediately. In one patient, after several intensive treatments, a slow growing epithelioma developed on the lateral surface of the tongue near its base. In another patient a very rapidly growing epithelioma appeared in a patch of leukoplakia after two intensive treatments. Schamberg reports a case where an epithelioma developed in a patch of leukoplakia one year subsequent to x-ray treatment. At present MacKee prefers to remain noncommittal regarding the advisability of treating leukoplakia with radium in preference to other methods. Small patches he thinks can be cured, but they can be cured with greater certainty by other methods such as the galvanocautery. Judd has for years destroyed leukoplakia with the actual cautery and the records of the Mayo Clinic do not show that this method has been followed by evil results. Hazen, too, has found the cautery at red heat with local anesthesia to be best.

The reviewers feel, both from observation and from the literature, that radiation has not always been successful and that there have been certain objectionable features following its use. Disregarding the possibility of actual cancer following radiation as shown in the cases of Schamberg and MacKee, its use is not infrequently followed by an induration that worries the patient as well as the surgeon more than a leukoplakia and has called for a more difficult excision than would have been the excision of a primary leukoplakia. It is felt, therefore, that treatment with radium should still be regarded as *sub judice* while excision is of proved value. When radical treatment is called for, Blair excises the patch, going not deeper than the mucosa and if the space is too large to approximate the edges by immediate suture, he follows excision by an immediate inlay Thiersch graft on a wax form. This he believes to be the most satisfactory plan of treatment he has yet tried. The one important fact in dealing with a leukoplakia is not to irritate it. Use emollients on it, never irritants. As the English put it, smoking, spirits and spices, the three S's, should be avoided. Butlin says that if a man must drink, he should take his spirits very much diluted, and if he must smoke, it should be a cigar with a long holder, smoked very slowly.

Even more important than a knowledge of the conditions which may predispose to cancer is that of the early appearance of the disease itself. Butlin mentions five conditions which he considers the most typical and most frequent forms of cancer of the tongue in its early stages. (1) A little plaque-like hard sore, smooth and polished but neither ulcerated nor excoriated. (2) The transformation or replacement of a simple ulcer by a cancerous ulcer which only differs from the simple ulcer by feeling a very little stiffer and a very little firmer. (3) The transformation of an entire plaque

of leukoplakia into a plaque of cancer. The change is marked by very slight thickening, a denser white, and furrowing and fissuring in various directions but without excoriation or ulceration. (4) The transformation of one small area of leukoplakic tongue into cancer, only marked at first by very slight and superficial hardening. (5) A white warty growth or compound wart, neither broken nor ulcerated and feeling at first as if it were fixed to the mucous membrane and quite superficial. In his early writings, Butlin classified certain papules, warts and slightly indurated ulcers that were always followed by the development of clinically typical carcinoma as "precancerous." Later, after finding that most of them were really cancer from the beginning he said, "I am now wondering whether there are really any conditions, perceptible to touch or sight which are precancerous in the sense in which I have been accustomed to employ them." Bloodgood takes the opposite view and has regarded all of these as really precancerous lesions.

There are certain characteristics of cancer which it is very essential to remember: (1) *The chronicity of the disease.* Once begun, cancer rarely recedes. An exception to this is the fact that a true cancer of the lip, the rodent ulcer, may recede and even scar over, only to break down again; but with squamous cell cancer this does not occur. In the early stages, the only suspicious thing about cancer is that after removing what is thought to be the source of irritation, the condition does not clear up. (2) *The continuous growth.* Not only does cancer not recede, but it is progressive in its growth, Any slowly extending induration in the mouth of a man more than thirty years of age should always excite grave suspicion. Even where there is an apparent cause for the induration, vigilance should not be relaxed until it has entirely subsided. (3) *Induration.* The induration is often of a hardness which is difficult to mistake for anything else. It is best detected by pinching up the suspected tissue between the finger and the thumb. (4) *Ulceration.* This may be the earliest objective sign. It is always surrounded by a wall of new growth in which the ulceration occurs. It may appear over a large surface before any induration is felt. (5) *Pain* is the most distressing subjective symptom. It may be present from the very beginning. It is not infrequently the first symptom for which the patient consults the physician, but it may be absent until very late in the course of the disease. These are two important points to keep in mind. The pain may be sharp, aching or gnawing and may radiate into the surrounding structures as far as the ear or even the vertex. (6) *Involvement of the lymph nodes.* The unexplained lymph node in the neck of an adult of cancer age should always be regarded with cancer suspicion. The primary lesion may be difficult to find, or may be very small. *In the presence of squamous cell epithelioma of the mouth, the lymph nodes should always be considered as already infiltrated.* This is the only safe rule. Sometimes the manifestation of the glandular involvement may be long delayed. Butlin and Blair both have reported cases where carcinomatous glands become enlarged eight years after the primary lesion had been cured, but usually a few months is the limit of the inactive period. Butlin says concerning this point, "Extension of cancer to the lymphatic

glands occurs at an earlier period and more widely than is generally obvious to clinical examination." This unwelcome truth has come to be recognized by observation of the course of cancer, where no operation has been performed, of the great frequency and the early development of glandular enlargement where the whole of the disease in the mouth has been successfully removed and by careful microscopical examination of the glands removed in the course of submaxillary operations.

The two chief factors that account for failure to make an early diagnosis, excluding ignorance and selfish motives which might actuate a few, are (1) a sentimental attitude which leads the physician to regard the lesion as nonmalignant until it is proved to be cancer, and (2) a misinterpretation of the report of microscopic findings. If the first consultant would consider every wart, every superficial induration and every persistent fissure or ulcer as cancer until proved otherwise and would regard with very grave suspicion every negative microscopic diagnosis or diagnosis of inflammatory tissue, then the whole chapter of cancer of the face and mouth could be rewritten in a very much more cheerful tone.

ULTRAVIOLET IN ORAL SURGERY

By A. J. Pacini, M.D., Chicago, Ill.

ORAL INFECTION, like infection anywhere, presents a double concept which includes:

1. A lessened resistance at the site of infection.
2. An infecting organism.

It is essential to remember that the diminished cellular resistance is no less important in the clinical entity of infection than is the infecting organism; a fact that has been too often neglected in medicine and in dentistry.

Speaking simply from the viewpoint of the obvious, the attack upon the pathology of infection can be such as:

1. To raise to resistivity and vitality in the cells of the infected area.
2. To destroy the organism inducing the infection.
3. To resort to a combination of both attacks.

Usual bactericides and germicides operate by destroying, chemically, the protoplasm of the infecting organism. They are in this sense active in compliance with the second requisite just mentioned. But they only partly comply with this requisite; for while the bactericide exerts lethal influence on the organism, it does at the same time exert an equally lethal effect on the cells in the area whose vitality is already much impaired. Anyone familiar with clinical activity has seen ample demonstration of this great truth. By applying a germicide to an infected area, the immediate manifestation consists, most usually, in an *increased* discharge of pus. This increased discharge of pus is accounted for by the destruction of many cells whose vitality is already low through the action of the germicidal agent.

It does not seem that dentistry has resorted much to systemic uplift for the obliteration of infectious pathology in accordance with the first postulate; that of increasing the resistance of infected cells to the point where infection cannot exist. The medical examples for this form of therapy are many, being most brilliantly summarized in the case of tuberculosis. In this infection, the bacillus remains so inaccessible as to preclude the possibility of immediate attack through the use of suitable bactericidal formulas. The best treatment has been found to consist generally in measures that point to systemic uplift such as forced feeding, prolonged rest, hygienic improvement.

It seems certain that one could expect more efficient therapeutic reaction if there could be provided a means for insuring, at the same time, the destruction of the bacterial organism of invasion and increasing the resistance of the cells in the infected area; and it so happens that ultraviolet energy seems capable of accomplishing both these desired effects under certain suitable conditions such as obtain in oral pathology. So that it is imperative that there should be a clear understanding of this important mechanism.

A cell, whether it represents a bacterial organism or a single unit in any of the body tissues, is chiefly a mass of protoplasm; by which is meant that its solid part is comprised largely of protein material. Proteins, according to the established concept of physiological chemistry, represent a complex structure built up of a number of individual units, each unit being called an amino acid. Abderhalden, the physiologic chemist, picturesquely called amino acids "Bausteine" (meaning building blocks).

Each protein presents individual characteristics which are dependent upon:

a. The variety of amino acids present in the protein molecule.

b. The percentage amount of each amino acid present in the molecule.

About fifteen or seventeen amino acids are basically predominant in all of the proteins that make up the pathogenic bacteria and the individual cells of the human tissues, in both of which the dentist and the physician are interested.

Practically all of the amino acids were studies as to their behavior under the influence of ultraviolet energy (Soret, Kober and Harris and Hoyt) and it is established that, in general, there is nothing strikingly peculiar about the action that amino acids display under the influence of ultraviolet. This is expressed by Kober in the sentence that practically all of the amino acids show a very general ultraviolet absorption.

But there are two striking exceptions. These include phenylalanin and tyrosine; and these two amino acids show a marked absorption for ultraviolet such as is not shared by any of the companion "Bausteine."

Certain proteins, when ingested, produce an effect which is characterized by an undue sensitivity to light on the part of the individual. Zein (from maize) is especially active in this regard and is thought by many to be responsible for the sensitivity to light manifested by pellagrins. It is interesting to observe that the usual proteins from beef, chicken, fish and wheat, contain only about 2 per cent of phenylalanin; but that zein, the protein of yellow cornmeal, contains over 6½ per cent of phenylalanin. And it is obviously this increased amount of phenylalanin that is conducive to the unusual light sensitivity which forms a part of the pathology of pellagra.

It happens that the phenylalanin and tyrosin content of the proteins comprising tissue cells is not generally high; but that the proteins comprising bacteria such as staphylococci and streptococci show relatively high percentages of these two amino acids.

Here, then, is the explanation for the remarkable paradoxical duality of ultraviolet energy. Human cells and organisms of disease exposed to ultraviolet energy respond differently because the one is destitute of phenylalanin and tyrosin and the other holds quite a high proportion of these photosensitive amino acids. In other words, bacteria are selectively absorptive for ultraviolet energy by reason of their protein composition which differs somewhat from the protein composition of only the generally absorptive tissue cell.

It is for this reason that ultraviolet energy plays such a useful part as a therapeutic agent in the pathology of infection; for when it is displayed on

an infected surface it lends its cellular regenerative influence to the wasting cells, and at the same time it sheds its strongly toxic effect on bacteria. Thereby does ultraviolet energy produce the effects of two desired therapeutic postulates, which effect is derived in a manner that is efficient and safe.

It remains to be discussed in what type of dental pathology the ultraviolet energy has proved itself useful in the capacity just mentioned; and together with this mention it is profitable to offer also a discussion of how best to apply the ultraviolet energy to insure the full share of brilliant success that it is capable of affording when utilized properly and on the basis of scientifically propounded precepts.

DEPARTMENT OF DENTAL AND ORAL RADIOGRAPHY

Edited By
Clarence O. Simpson, M.D., D.D.S., and Howard R. Raper, D.D.S.

USEFULNESS OF AN X-RAY MACHINE IN ORTHODONTIA*

By Dr. Charles S. McCowen, Palo Alto, Calif.

THE x-ray outfit as a factor in the practice of orthodontics is invaluable and the question comes up as to whether each man should have his own outfit in the office. You may have a radiographer across the hall or very near but will you call upon him as often as you would like? Sending patients out means turning over this extra expense to them, and therefore, we dislike to have too many pictures taken. Then, of course, the radiographer may be unable to take the pictures at once, or the patient cannot go, and we do not get the films when they are wanted. But with a machine you can have pictures taken to examine within eight or ten minutes.

When an exposure is made for any purpose you can diagnose more easily knowing the angle and conditions of exposure.

There is an advantage to those who make no charge for examination, as in most cases films are necessary before advice can be given or fee set, by making a charge for the necessary pictures an examination fee is established without question. Later, if the case is accepted, credit may be given for this fee. I make no charge for x-rays since they are part of the service.

Some men may not care to have a machine on account of the danger to the patient or to the operator, but, with a good machine, short exposures, the apparatus well grounded, and ordinary care in limiting the number for each patient, no ill effects may be feared and lead screens for this work are not necessary.

A set of pictures should be taken before any case is started or fee mentioned—this is even more necessary than taking impressions. Take for each case two extraoral plates showing canine, premolars, and molars of each side; a bite-plate for upper anteriors and intraoral for the lower. Later on individual films may be taken as the work proceeds.

A good profile radiogram may be made which will show the soft tissues of face with an outline of bone showing the relations of bone to contour of

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face. This may be made in the following manner which seems to me to give the best results. Allow the patient to stand about fifty inches in front of a tube placed horizontally, with the plate or film holder held against the face. Use a soft tube, ten M.A., four and a half spark-gap, and give six seconds' exposure for duplitized films; if screens are used of course less exposure is necessary. I believe there is some diffusion of the rays as the tube is placed

Fig. 1.—Profile radiogram of a case of mesioclusion.

Fig. 2.—Profile radiogram of a case of distoclusion.

farther away from the film. These profile radiograms are valuable to note changes in structure, and by using a transparent linear chart can be studied accurately, making at least two, one before and one after the work is finished. These can be filed away with other records. As I have just developed the profile radiogram I can only show samples of first exposures.

In starting a case you also want to know whether teeth are missing or supernumeraries are present, the angle of certain unerupted teeth, the condition

of bone at different times and size of the teeth. You may have space for a canine tooth unerupted; and very accurate measurements may be made from a radiogram of that tooth. Impactions taken from different angles will show their position for surgical procedure. If you want to tell whether an impacted tooth is buccal or lingual, take one picture directly at right angle, another one by shifting the tube and you will find the tooth nearest the tube side will move further away.

Fig. 3.—Profile radiogram of a case of mesioclusion.

Films may be made of appliances for record, both on the model, or without model, or in position in the mouth and can be used to change appliances.

The radiogram of appliance in place on the model can be made by painting the model outlining the teeth only with a pure lead paint, placing the model on the film. A fair picture is obtained; however, the usefulness of this is limited but may be useful at times. With films you will have a complete record during all stages of the case, can note inflammatory changes in bone from too long retention, find teeth that have been treated previously, note whether

it is wise to use treated teeth for abutments and having the x-ray at hand at all times you will find it a valuable auxiliary to your work.

Fig. 4.—Teeth painted with white lead. Model radiographed with appliance in place.

DISCUSSION

Dr. Leland E. Carter, San Francisco.—Dr. McCowen has touched on a subject that I fear has not been given the proper consideration in the practice of orthodontia. There is a tendency however, to pay a great deal more attention to the value of radiography in orthodontia than heretofore. The majority of our textbooks have little to say relative to the application of the x-ray in orthodontia. I believe that Dr. McCoy has included a chapter on radiography in his new book, and that I believe is about the only mention of radiography to any worth while extent in any of our textbooks. We hear much about the necessity of plaster impressions, case histories, etc, but that does not include a full radiographic examination of the mouth and to my way of thinking a full set of radiograms is just about as important as a very accurate plaster model. Perhaps you could get along without the radiograms better than you could without the models, but in many instances where you do not make a radiographic examination a little later on you will perhaps wish you had not spent so much time on your plaster models and had spent a little time in making a radiographic examination.

There has been considerable controversy as to the question whether it is advisable for the orthodontist to install an x-ray apparatus in his office. That is a matter which I do not believe can be settled here. There is one thing which I believe would decide that, i.e. whether or not the man who is installing a radiographic outfit will take the work seriously, or if he is going to use it as a sort of plaything and take radiograms just good enough to "get by." It may do more harm than good unless he takes the work seriously and realizes he must acquire a technic in radiography.

Dr. McCowen brought up a very good point when he mentioned that many times you can hold the patient's attention, or rather discourage shoppers by charging a consultation fee or an examination fee, and a nice way to get around that without insulting the patient would be to make an x-ray examination before you do anything else, and make a charge for that part of the examination.

In regard to the profile made radiographically which Dr. McCowen has shown us, I want to utter a word of caution if any of you attempt to make records of this kind. Carelessness in making these radiograms might be very serious. You must take into consideration that unless you can have the patient in absolutely the same position, the profile in absolutely the same relative position, with direction of the rays the same as when the original radiogram was made, then the resulting profile picture is practically of no use whatsoever. In fact it would fool you and make you believe you had accomplished something you had not accomplished at all. So very careful technic must be followed, and you must have ab-

solutely the same position in the second exposure that you had when the original radiogram was made.

There are so many advantages in making a radiographic examination that to cover them all it would almost be necessary to mention all the operations in dentistry. Dr. McCowen has mentioned the importance of the radiogram in the case of impacted canines. There is one use of radiography he has omitted to name, and that is for the detection of incipient caries. All of you gentlemen know that one of the things you have to contend with is carious teeth. For instance where you have a first molar with the second deciduous molar in place and decayed, you are very likely to find the mesial surface of the first permanent molar pitted. It is sometimes difficult to detect that unaided by radiography. You all have to send children out to have their teeth filled and they return, and while you are exploring around you find a pit or cavity in some of the teeth that the dentist has overlooked. You can demonstrate these cavities with the radiogram. Then if you send the radiogram to the dentist, marked to show what you have observed, you probably will not be embarressed by having to send the patient back a second time.

Another valuable use for the radiogram is this. Where you send a patient to the dentist to have a filling put in and that patient returns with an amalgam filling showing a nice little overhang, a nice little shelf on the molar you may be wanting to band, and when you come to separate the tooth you cannot get your separating material in place, thus interfering with the decent fitting of a band; it relieves you of much embarrassment in some instances if you simply make a radiogram of the tooth in question and send it back to your dentist and you do not need to say anything to him about it at all. He is generally thankful and restores the tooth as it should be.

With regard to painting the teeth on the model with lead paint and making a radiogram or record of the appliance, I had not thought of that. I imagine it would be a very good way to keep a record of the first appliances you put on or any other appliances you might use afterwards, so that you could use them for comparison and you might be able from your first record of this kind to design an appliance with which to carry the case on to a further stage.

I am sorry I did not have an opportunity to give this paper a little more thought before I was called upon to discuss it, because as I said before, radiography is a very important phase of our work and should be taken very seriously indeed.

Dr. Jas. D. McCoy.—We have with us today the first orthodontist in the United States who established an x-ray laboratory of his own, and who was also one of the first dentists in the United States to use the x-ray to any extent. This gentleman is an honorary member of this Society and one of the contributors to the program today, and I am glad to call on Dr. A. H. Ketcham of Denver to continue this discussion briefly, if he will.

Dr. A. H. Ketcham, Denver.—Mr. President, gentlemen, and members of The Pacific Coast Society of Orthodontists: I was forced to take up radiodontia in my orthodontia practice nearly twenty years ago. This was fortunate because knowledge of the technic employed enables me to make a more accurate diagnosis. It is worth while for every orthodontist to have an x-ray apparatus and to become proficient in its use. We know that much of our success in the treatment of cases of malocclusion depends on diagnosis, and we can not make an intelligent diagnosis without a thorough radiodontic examination. Besides the radiographic examination has a beneficial psychologic effect upon the parents or guardians of our prospective patients, for showing radiograms of the unerupted teeth in their crowded conditions forms a splendid object lesson.

I must urge generous use of the dental films. In cases where none of the permanent teeth have erupted, we should make separate exposures for the incisal, canine, and deciduous molar regions, and also extraoral plates, including the deciduous molar region and unerupted permanent molars. If incisors have erupted we need films for the canine region as well as films for the deciduous molar region and extraoral plates for the permanent molar region. If all permanent teeth which should succeed the temporary teeth have erupted, then make extraoral plates of the second and third molar region. By these procedures many interesting

things will be learned. In about one out of ten patients, one or more of the permanent teeth which should succeed the temporary teeth are missing. It is necessary before we can arrive at an intelligent diagnosis and treatment of the case, to know whether all of these teeth are present. A point to remember: Sometimes you will be mistaken in diagnosis unless you read correctly the presence or absence of a tooth crypt. It is possible for the calcification of a tooth to be delayed for years and then to go on. For instance, in a case of a nine-year old boy, the radiograms showed congenital absence of five permanent teeth; viz., the mandibular central incisors and second premolars, and the maxillary right lateral incisor; also the maxillary right second premolar was apparently congenitally absent and this four or five years after calcification of the crown should have taken place or started, and the crown of the second premolar on the opposite side of the maxillary arch was fully calcified. A faint outline of the crypt for the right second premolar was visible and within two years calcification had taken place in that crypt. Now the tooth has erupted and is normal. According to Brady's chart the average age for calcification of the third molars to begin is eight years. We have in some cases at ten or eleven years of age found no evidence of calcification of the third molars and sometimes the presence of the crypt could not be determined, but later on calcification has started and within two years the crown of the third molar has been formed.

You will often discover impactions and had you gone on without radiograms, made your diagnosis, naming the fee for treating the case, you would be "up against it" later on. So I say by all means make a thorough radiographic diagnosis of each and every case when the patient first presents for consultation. Also be very careful to check up all pulpless teeth with dental films before you start treatment. As we proceed with the treatment we should have the x-ray at hand to check up the different steps of our work. By doing these things I think we all will be giving our patients a greater and grander service.

Dr. Allen H. Suggett.—Several years ago Dr. Wauck sent out a questionnaire, asking how many teeth had been devitalized through the correction of malocclusion. It was surprising in looking over the answers to note that many leading orthodontists reported superior laterals, premolars, etc., where devitalization had been brought about. I was surprised at that. On the other hand, in thinking it over the data was not so valuable. Not knowing the technic of these men it was questionable whether these unfortunate results were avoidable or not. Later on in taking impressions for a patient I noted the right superior central was devitalized. That caused me to think and I wondered whether these reported cases were cases that might have been overlooked at the start. By following this matter up a number of years I discovered a good many pulpless laterals, premolars and centrals before appliances were ever put on, so I came to the conclusion that most of these men were mistaken. I believe it practically never happens that any man of careful technic will devitalize teeth in correcting malocclusion. I feel pretty sure of it. So I believe if those men responding to the questionnaire, had resorted to the radiogram they would have found these teeth were nonvital before treatment was begun.

In following up the cases at the college there have been but one or two instances that I know of positively, where devitalization seemed to have been caused by treatment, and you know there are some pretty raw treatments in dental clinics, especially the work done a few years ago. Teeth will stand some pretty rough treatment without devitalization. All of our cases should be radiographed before treatment is commenced.

Dr. McCowen, (closing).—I have to apologize to Dr. Carter for not giving him a copy of the paper sooner as, with his knowledge of radiography, he might have made his discussion still more interesting. A matter Dr. Suggett brought up strikes me as important. So many children have accidents in childhood, especially to the central incisors, chipping them and frequently causing devitalization. Knowing this condition at the outset one is able to avoid unpleasant complications later on.

THE TECHNIC OF ORAL RADIOGRAPHY

By Dr. Clarence O. Simpson, St. Louis, Mo.

(Continued from page 148.)

INTRAORAL EXAMINATIONS (CONTINUED)

Orderly Procedure.—Systematic procedure commands the confidence and cooperation of the patient, expedites the operation, and is conducive to superior results. With a little training, orderly methods will become a habit and a constant source of satisfaction.

All preparations for the examination should be made before the patient is ushered into the room. These preliminaries include the preparation of the chemical solutions in the darkroom, testing of the apparatus, providing a supply of films in the customary protected location, and arrangement of the light and ventilation. The operator's hands should be washed while the patient is being seated, so he can proceed at once with the clinical examination.

Clinical Examination.—The first step is a general inspection of the mouth for removable appliances, abnormalities, pathologic manifestations, and dental conditions. This preliminary inspection usually reveals factors having a direct bearing on the x-ray examination, and is the means of avoiding many subsequent complications. Spectacles, artificial dentures, and other impedimenta should be deposited in a safe place to prevent their falling or being a cause of distraction.

Precautionary Measures.—The patient should then be questioned about recent exposure to radiation, as a precaution against excessive exposure in this era of promiscuous and incompetent oral radiography. This information may be obtained without exciting fear, by asking if the patient is familiar with the operation, and when the answer is to the affirmative, by asking how recently and to what extent radiation has been applied. In case the patient has recently been subjected to considerable radiation, the examination should be deferred until two weeks after the last exposure. If circumstances make a risk of excessive exposure advisable, it should be explained in detail and the consent obtained before proceeding. This discharges the moral obligation, but if legal responsibility is to be fixed, a dependable witness should be present during the conversation.

Allaying Fear.—Radiographic examinations are still enough of a novelty for many persons to approach them with curiosity or fear. It is a duty of the operator to allay the fear, and of great assistance in securing successful results to briefly explain the procedure. To arbitrarily state that there is no danger will likely provoke a citation to the contrary, and to state that it is painless may be disproved to a sensitive patient before the examination is completed. A few words of intelligent explanation will be appreciated, and

this should include assurance of protection from electric shock, the comparison of the exposure required for radiography to that which might be injurious, and a promise of no sensation except the discomfort from placing the films in the mouth. To permit these statements being truthfully made, have equipment, manipulative skill, and sufficient knowledge of x-ray dosage to give the greatest degree of safety.

Having the transformer some distance from the chair, and in the unit types designed to extend over the chair from the rear, having the tube reversed so the transformer will be in front of the patient will reduce the fear of concealed danger and proximity to electric apparatus. Passing the current through the tube to familiarize children and nervous adults with the effect before posing them aids in relieving the tension.

Beginning the Examination.—The patient should be posed and the tube adjusted to approximately the desired position before the film packet is placed in the mouth, so the period of retention will not be unnecessarily prolonged. Then the film packet is placed in position, the final adjustment of the tube made, and the exposure begun as rapidly as possible.

The first exposure is more likely to result in failure than subsequent ones because of the patient's inexperience, and the instructions must emphasize the necessity for cooperation. When several regions are to be examined, the one presenting the least difficulty to the patient should be radiographed first.

Sequence of Regions.—Systematic methods are especially indicated in general radiodontic examinations for uniformity and thoroughness. By radiographing the regions in the following order, there is a marked advantage in anticipationg unusual conditions, and determining the most favorable projection point by inspection of the negatives from preceding exposures.

Regions in order of examination:

Left maxillary canine.
Left mandibular first molar.
Left mandibular second molar.
Left maxillary first molar.
Left mandibular canine.
Mandibular incisors.
Right mandibular canine.
Right maxillary canine.
Maxillary incisors (median view).
Right maxillary first molar.
Right maxillary second molar.
Right mandibular first molar.
Right mandibular second molar.
Left maxillary second molar.
Left maxillary incisors.
Right maxillary incisors.

The advantages in beginning with the left maxillary canine region are: the slight discomfort from the film packet; the accessibility of the region;

the opportunity of observing root and bone characteristics in the incisor and premolar regions; combining the possibility of misjudging the length of the canine root with the uncertainty of the initial exposure; and the use of the right hand in becoming familiar with the retention of the film packet.

It is assumed that the films are to be developed as the examination proceeds, for when this is not done the procedure is merely guessing at the most favorable aspects, without an inkling of the information being recorded, and without an opportunity for correction or further investigation, unless the patient remains or returns after development of the films. The exposure of a predetermined number of films at an ultra-safe angle of projection, and dismissal of the patient, is mechanical radiography, not a radiodontic examination. Even when a darkroom assistant is not available, the films should be developed during the progress of the examination.

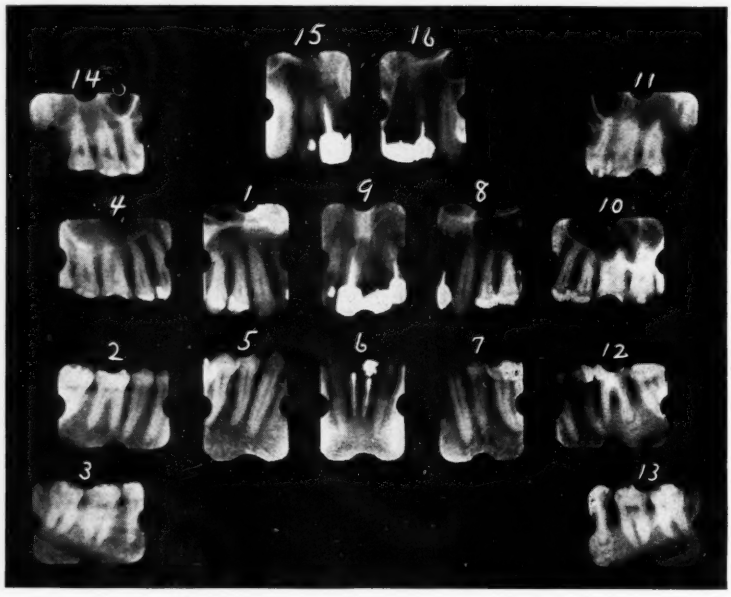

Fig. 1.—Chart showing the sequence of regions suggested for a general radiodontic examination.

The mandibular molar regions offer little technical difficulty, and those on the left side may be exposed while the first film is being developed, or they may be developed with the first if the operator must do the developing. When the negative of the canine region is ready for inspection, the operator is able to modify the penetration and exposure, and calculate the approximate angle of projection for the maxillary incisors, canines, and premolars.

The fourth exposure should be for examination of the left maxillary premolars and first molar, since the angle of projection must conform to the premolar conditions disclosed by the negative of the canine region. For convenience in poses and chair manipulation, the left mandibular canine, mandibular incisor and right mandibular canine regions are next exposed in order, utilizing the information obtained from the negative of the mandibular first molar region. Then the right maxillary canine, and the median view of

the maxillary incisors are radiographed in conformity to the angulation suggested by the negative of the left canine region.

The chair is then reversed for the right maxillary molar regions to be examined as indicated by the record of the left maxillary first molar region. While these are being developed the right mandibular molar regions are radiographed with any modifications suggested by the negatives of the left side. When the right maxillary second and third molar negative is ready for inspection, the left can be radiographed with more confidence by correction of any miscalculation. This leaves the two diagonal views of the maxillary incisors which present little difficulty after studying the median incisor and canine views.

This method tends to equalize the exposure of the face to radiation, by dividing the difficult steps of the examination between the left and right sides in determining the general character of the roots and bone on the left, and the most favorable aspect of the second and third molar region on the right side. The probability of miscalculation is greatest in the maxillary canine and the first molar regions which were first examined on the left side, and the maxillary second and third molar region which was first examined on the right side. However, there is a possibility of technical errors and movement in any region, and during the examination all negatives should be studied with the motive of obtaining the desired information and perfecting technical deficiencies.

(To be continued.)

RADIODONTIC RIDDLES

Conducted by Clarence O. Simpson, M.D., D.D.S.

A Department Devoted to Discussion of the Scientific, Technical, and Ethical Problems of Radiodontia

The Worm Turneth

My dear Editor:

First of all, permit me to protect myself from your justly famed vitriolic pen, by both admitting and proclaiming your virtues and accomplishments, as being of the highest order. I believe in you and your kind, and may your seed fall on fertile soil, and people the world with intellectual giants endowed with your virtues, and thereby speed the coming of the millenium. "Allah! be praised," etc. Now, am I safe?

This is not a mash note, but simply a plain statement that I read your stuff wherever and whenever printed—and I like it.

Seriously and sincerely, I do believe in you, and am convinced that you measure up to that high standard that a man should at least approximate, if he is to set himself apart from and above, if you please, his fellow practitioners, and label himself "SPECIALIST." But the ordinary run of unsuccessful, discouraged, and disgruntled, general practitioners, who, out of their unmatchable conceit, grasp the laurel wreath of exceptional achievement in any given subject, and dub themselves "specialists"; and from then on, thenceforth, and forever after, forget their humble origin, and when they chance to refer, inadvertently, in speech, or in their voluminous contributions to current dental literature, to their erstwhile playmates—the general practitioners—they do so with a condescending tone, filled with pity, for those poor benighted men whom God forgot when handing out congenital doses of conceit and gall.

Why, my dear Clarence, I once knew a distinguished specialist who received his diploma fresh from the "mill" one day, and on the next, had a legend inscribed on his office door, which, among other self-laudatory and untrue statements, informed the casual passerby that the gentleman within was a diagnostician, and that same gentleman has been lying awake nights ever since for fear that some of the ordinary working boys in the sorting stations would, through innate crudeness, or congenital dumbness, do something which would lessen the dignity of the profession which the aforementioned diagnostician had deigned to grace. God give me strength to control myself, and prevent my using adjectives hotter than this cheap paper I am compelled through necessity to use, will stand.

When it comes to "Inconsequential outlying dentist"—that's me—and it also means a lot of other ordinary, straightforward sons of decent parents who are doing their particular job in the best possible workman-like manner. It is true that we do not receive a bank president's salary for three or four hours' time spent at the office along about the middle of the day, and, consequently, are not able to go about the country adding to our reputations in a way that directly reflects its benefits by an increase in our bank accounts; nor are we permitted to circularize our possible patients every month or so. In fact, it seems to me that the time is drawing near when the D.D.S. will stand for "Doctor of Dental Sorters," and our modest door plates will read: "Dr. John Doe, Dental Sorter."

If it were not for the "Inconsequential out-lying Dentist" who barters his services for a reasonable fee, 90 per cent of those having dental ills treated today would be compelled to go toothless to untimely graves, owing to lack of funds to pay those super-dentists who exact a King's ransom for what, in many instances, proves to be only ordinary service.

I agree with you in so far as the so-called laboratory is concerned, and I believe that you personally shake the nastiest little spark gap in these parts, but, for the love of Mike, lay off the neighborhood and outlying dentist. Try some other anvil—it will make just as many advertising sparks.

In closing, the next time you exchange high frequency with your friend Jelinek, tell him to change his dosage—he is using too much snow.

The above, my dear Clarence, is the result of the last straw having been placed on the poor old camel's back. Kindly accept it in the spirit in which you know I have written it, and believe me your most ardent personal and professional admirer,

(Signed) Jay P. Marshall.

A.—"Atta" boy Jay, welcome to our merry little society for correction. Flattery is such a novelty in the life of a radiodontist or dental detective that your praise, although it may have been written with crossed fingers and mental reservations, will be treasured among scant worldly possessions. Your objections are sustained, and the argument for the defense enhances your deserved reputation as a leader of men, and an anti-Volstead post-prandial "roastmaster."

Dr. Jelinek probably did not intend to humiliate dentists because of their location or lack of professional prominence, and perhaps he ironically used the expression to reflect the attitude of some specialists toward general practitioners, but an unqualified reference to "inconsequential outlying dentists" is a breach of courtesy which justifies your protest.

It is not the purpose of this department to disparage the efforts of any one who is "doing his job in the best possible manner," and it is hoped that nothing has been written to create this impression. General practitioners in city or country who are earnestly striving to give their patients modern dentistry are a credit to the profession, and should be honored as valuable servants in their respective communities.

However, since you have incited the issue by unqualifiedly championing

the cause of the "workman-like" philanthropist of decent parents known as the neighborhood dentist, the subject may be impersonally discussed in the interest of truth by dispensing for the moment with superfluous sentiment. Evening hours, low fees, and a pessimistic view of dentistry, do not guarantee either honesty or competency. If a dentist does not attend scientific meetings because he can see no direct financial gain, does not read technical literature, does not affiliate with study classes or only attends on favorable nights, does not practice asepsis, but ridicules the danger from oral sepsis and by deception derives most of his income from ill-fitting shell crowns; inconsequential is too mild—he is a menace.

Excepting the relief of pain, inferior dental operations are not beneficial to the recipient, however small may be the fee. Inferior medical treatment may do no harm so long as it does not impair vital functions or defer imperative surgical aid; inefficient legal representation usually results in nothing more serious than material loss; the deficiencies of ministers only bore one without jeopardizing the prospect of salvation; but defective dental operations cause irreparable injury. The victims of pernicious dentistry, which produces physical destruction, have inadequate assistance from nature, a jury of their peers, or divine justice; only a competent dentist can relieve them. So before weeping over unjust criticism, let us consider the motives, opportunities, and methods of those to whom it is applied. The mere classification as general practitioner or specialist does not establish one's status as a proficient professional gentleman.

You have expressed the limit of buccal capacity, to transpose the inelegant equivalent "said a mouthful," in suggesting that an itching discontent, an embossed announcement, and a gilt sign do not make a specialist. Ah! but what does make a specialist? Not always special qualifications, intensive preparation, and consecration to service, but often subsidized associates, influential affiliations, surreptitious solicitation, fee manipulation, and favorable circumstances to procure patients, a condition which will prevail so long as the laity are deceived by, and the professions connive with, spurious imitators and, until dentists and physicians refer patients with the sole object of offering the best service obtainable.

As one of the most undignified and unprofessional practices in dentistry, the circularization by reference charts should be stopped, but custom and tolerance permits it to continue. The writer in discontinuing this procedure four years ago, has encountered opposition from dentists who do not resent the advertising feature, but find it a convenience. When reference charts are not issued periodically, some men view it as an independent attitude indicating that one no longer desires to have patients referred, and it will require concerted action to correct the evil.

Your clever sally about general practitioners "evoluting" into dental sorters, presumably implies that the development of specialization will result in the neighborhood dentist's just examining the patients who apply to him, and then referring them to specialists for the treatment indicated. Perhaps without realizing the tremendous import of the idea, you have conceived a

plan which will solve the heretofore insoluble and insolvent problem of general practice.

Why not let the neighborhood dentist serve as a "sorter" with a more impressive title of Doctor of Diagnostic Stomatology? His practice will consist of examining applicants and referring them to specialists for treatment, which will relieve him of his present task as a lightning change artist, by passing the actual labor to others. By charging a nominal fee of $2.00 for the examination with a prescription, and sorting 50 or more patients per day without the expense of supplies and laboratory subcontracting, the practice should be attractive and lucrative. Doubtless when the educational campaign of the manufacturers and dealers has been assimilated by the public, there will be an insistent demand for compulsory dental examinations, similar to vaccination and quarantine regulations, and thus the general practitioner may live happily and thrive thriftily ever afterward, with specialists doing the work.

ABSTRACT OF CURRENT LITERATURE

Covering Such Subjects as

ORTHODONTIA — ORAL SURGERY — SURGICAL ORTHODONTIA — DENTAL RADIOGRAPHY

It is the purpose of this JOURNAL to review so far as possible the most important literature as it appears in English and Foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

Dental Aspects of Nutritional Diseases in Central Europe. M. Epstein (New York). The Dental Cosmos, February, 1923, lxv, 2.

At the Dental Clinic at Berlin a vast number of cases of immediate and secondary hemorrhage are seen to follow extraction of the teeth and are brought into causal relationship with food shortage and other postbellum factors. The insufficiency concerns principally proteins and vitaminiferous foods. If there is suspicion of a tendency to hemorrhage the tooth socket is packed after extraction, a strip of iodoform gauze being pressed gently against the floor of the alveolus, and other strips superadded until the dressing is flush with the surface. Sutures of floss silk are applied over all, two being passed through the labial and two through the lingual aspect of the gum. After two days the packing is removed with extreme care, so that the blood clot will not be disturbed. If a hemorrhage occurs at the time, the process is repeated. If a row of teeth is removed a celluloid splint is utilized, which differs with the amount of extraction, whether total for the jaw or partial. The patient bites down on it and retention is completed by the suction exerted by the two moist surfaces in apposition. In partial cases the technic is more elaborate and must be read in the original. The local celluloid splint is a valuable contribution to oral surgery, for it furnishes a masticating surface. Should hemorrhage occur with the splint in position, compression readily arrests it.

An Important Legal Decision. Editorial. The Pacific Dental Gazette, January, 1923, xxx, 1.

A recent decision by the Supreme Court of the State of California has completely upset the findings of the Court of Appeals by the opinion expressed that any kind of prosthesis or orthodontic appliance is practically of the nature of a dental operation. That the element of mechanics enters into the case should not obscure the therapeutic purpose which is the fundamental object in view. The splinting of a fractured bone is recognized as a surgical operation and the conditions are parallel. The particular process concerned in the appealed case was the procuring of a replica of the mouth for an arti-

ficial denture, and the same practice is of common occurrence in orthopedic surgery. The Court found that the construction of an artificial substitute for a natural part of the body, including the dental organs, is an operation in the realm of surgery. The trial involved the prosecution of an unqualified man for the practice of dentistry, the defense having been that the alleged act did not directly involve the practice of dentistry, but only a mechanical accessory procedure.

Reimplantation of Teeth. A. Arnheim (Berlin). Zahnaerztlichen Rundschau, December 7, 1922, xxxi, 49.

Not so many years ago reimplantation was looked on as a good deal of a joke, something for charlatans to talk of. In the nineties of the last century legitimate efforts, begun along this line, have continued down to the present day. Schroeder was doubtless responsible for interesting a small circle of his colleagues in reimplantation. Fourteen years ago the author replanted a canine extracted through an unfortunate diagnosis. Five days had elapsed since the extraction, but the operation was successful. The author limits the subject to reimplanting the individual's own teeth as a form of autografting. Scheff, a pioneer in the subject, made in the nineties many experiments on the dog. There are two types according as the periosteum is adherent or detached. When a tooth is pulled some periosteum adheres while the remainder is left in the alveolus. If the tooth is reimplanted at once, a healing by first intention results through the union of the remnants of periosteum. If the tooth is reimplanted in a denuded state, the result is union by second intention. The tooth adheres to the alveolus and the pulp dies. The most direct indication for reimplantation is in traumatic loss of teeth and also when a tooth has been extracted by mistake. Aside from these cases it may be possible to replace teeth under circumstances in which some form of treatment of the roots or alveoli is associated. Among these is pyorrhea.

Dentistry and Its Relationship to Preventive Medicine. C. H. Mayo and J. G. Meisser (Mayo Clinic, Rochester, Minn.). The Dental Summary, January, 1923, xliii, 1.

Conservation of the teeth by every resource of art is not the most important factor in dentistry. Teeth still of service for mastication may require removal. Indiscriminate devitalization of the teeth by the dentists favors the multiplication of pathogenic bacteria, and this with neglect of mouth hygiene make infected teeth the rule. Many of the dentist's patients are healthy, know little of illness and do not come in contact with physicians. Such individuals should be informed of the true significance of mouth infection. If the patient is ill from his teeth he should be referred to the physician. At the Mayo clinic the teeth are examined in the dental department, roentgenograms taken and the patient sent back to the original medical adviser.

Many patients with pyelonephritis are found to suffer from oral sepsis. The connection is obscure, for the germ of the renal lesion, the bacillus coli,

figures but very slightly in oral sepsis. It was found by experiment that in such cases there is a mixed streptococcus and B. coli infection. In the urine the latter organism suppresses the streptococcus but this organism has an elective affinity for the teeth. Submucous ulcer of the bladder is also a streptococcus infection and even a form of chronic nephritis was traced to infected teeth. Various strains of staphylococci may replace or be added to streptococci in these cases, and in every type of clinical infection animal experiment has duplicated the spontaneous human finds, and we know that, as Rosenau long ago proved, hematogenous infection is determined by the fact that a given germ may have a special affinity for certain structures, whether joints, the iris, muscle, mucous membranes in various localities, etc.

Status Lymphaticus and Sudden Death. Abstract in The Dental Record, October, 1922, from Dental Items of Interest.

Considering the importance of this factor in cases of sudden death, it receives little attention in dental journals. It can seldom be recognized during life or perhaps even suspected; but in autopsies following death from trivial causes it is readily apparent. When present in high degree any of the manipulations in the dentist's office and especially anesthesia and extractions could in theory precipitate death. Dr. Tompkins gives the dentist some suggestions concerning suspicious cases. When the dentist entertains such suspicions he will of course either decline to use anesthetics or practice extraction, or will have a consultant of some kind on hand to divide the responsibility. These subjects are said to have a pasty, anemic look, a fine delicate skin, a voice high pitched for males, although the reverse is seen in woman patients. Hair is apt to be thin in the scalp (not from baldness), and absent from the face. There is some enlargement about the thyroid gland and perhaps swelling of the cervical lymph nodes. The men show no prominence of the Adam's apple. There may be evidences of rickets. The tonsils and adenoid tissue of the pharyngeal roof may be enlarged and the presence of a persistent thymus may be responsible for the absence of aortic pulsations in the sternal notch. The male contours may suggest a female and vice versa, but in each sex this results from the persistence of infantile characteristics; neither presents the evidences of complete development. A dentist who has once had an unfortunate experience of death from slight cause will naturally feel that he cannot afford a second happening of the kind, and fortunately death from status lymphaticus is rare.

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EDITORIALS

Evidence That the Present Requirements for Dental Education Are Too High, Also a Remedy for Existing Evils

WE have several times in the past been accused of heresy because we have stated the danger of educational requirements for the study of dentistry becoming too high. We have repeatedly called attention to the facts that dental education must be practical and that the attempts of certain individuals and schools to raise educational requirements so high as to make them impractical would lead to a condition that would be a detriment to the profession and public.

For a long time we have advocated this view alone, while our views have been considered sound by many men in the profession, practically no one has opposed the "powers" which have worked to advance the requirements of dental education to a par with medical education. These desires would seem to be well entertained if it were not for the fact that a great

amount of evidence exists which proves that the present requirements for medical education have reached a point where great harm is resulting to the medical profession and public because of these highly advanced educational requirements.

At the present time the medical profession has its "back to the wall" fighting for its very existence because of the great inroads that have been made by osteopathy, chiropractic, neuropractic, and other groups. The public has given these organizations recognition because, in the majority of cases they have rendered some service to the public. This may be because about 80 per cent of the people who are ill will make a satisfactory recovery, if they follow the advice given by the above groups. If requirements for medical education had not been advanced to such an extent as to make a medical education impossible for the average individual, there would not be the large number of pseudomedical cults applying for recognition at the present time. In some states they are actually practicing with the same privilege that is given to the medical profession.

We have been informed by good authority that the powers in medical education realize that something must be done to prevent this continual growth of osteopathy and chiropractic and "that something" must be a rearrangement of medical education to enable many of these students who are now studying osteopathy and chiropractic to enter recognized medical schools. Under the present plan of medical education, within a few years the osteopaths and the chiropractics will control all legislature and direct all public health measures and will be given the same privileges as men who have spent many years in obtaining a medical education, because they will so far outnumber regular practitioners. Regardless of the mistakes that medical educationists have made, a certain group of dental educationists who have control of the dental situation are rushing headlong into the same difficulty that confronts medicine at the present time. The dental profession as a whole has paid little attention to the situation and has been content to let a few control the affairs. The dental profession has been responsible for there springing into existence a large number of dental mechanics and the aforesaid dental mechanics have increased to a large number owing to the requirements for dental education. In New York State they have become sufficiently strong to make demands upon the state legislature for recognition. We have called attention to this possible catastrophe several times before, because no one has taken us seriously. The real situation is now forced upon the dental profession in New York City by Senate Bill No. 383, which has been introduced into the Senate and is now before the Committee on Public Health. It is a bill to amend the public health law to regulate the practice of prosthetic dentistry. Never in the history of dentistry has there been a Bill introduced which will do a greater injury to the dental profession if it should be passed.

This Bill is so worded than any dentist would be compelled to take out a license to practice prosthetic dentistry. No office girl or assistant will be allowed to varnish or pour impressions, invest or cast an inlay without

a license as a prosthetic dentist. Employees in dental laboratories and depots will be unable to select artificial teeth for plates or bridges.

The Bill is so far-reaching that it may result in its own downfall because of the opposition that is developing against it. However, should the dental profession, the Dental State Board and the Board of Regents succeed in showing the Legislature why this Bill should not be passed, such failure of passage will not be the end of mechanical dentists. We are informed on good authority that there are in the City of New York over eight hundred mechanical dentists and three hundred and fifty dental laboratories. The profession is to blame for the existence of these dental laboratories and mechanics and the system of dental education is responsible for the attitude of the profession.

We have always contended that no one should be allowed to do any part of dentistry, whether it be radiography, mechanical dentistry or oral hygiene, without possessing the knowledge required for a D. D. S. The reason advanced by men who favor the licensing of mechanical dentists is that the requirements for dental education have been so advanced that it is necessary to educate mechanics to do some of the work. Just as soon as dental mechanics are educated or developed, they will ask and obtain legislative recognition which will result to the disadvantage of the dental profession. They will not be content to call themselves mechanical dentists, because the Bill which has been introduced into the senate gives them the degree of Prosthetic Dentist.

We have already stated that the present impractical requirements for dental education are responsible for the increasing number of mechanical dentists and the only way to avoid that is to so change the present system of dental education as to produce a sufficient number of dentists to supply the public need. Instead of increasing the preliminary requirements for dental education and lengthening the dental term, it would be better to require four years of high school work and four years of dentistry and then provide postgraduate instructions which will enable these few dentists who wish greater training to go ahead and obtain it. It seems that the present plan of some dental educationists is to make a highly trained specialist out of each dental student, which is resulting in producing a small number of dentists and creating a field for mechanical dentists.

It is true we need the supereducated man but he should obtain that education as a result of postgraduate instruction, which plan would still enable us to educate a sufficient number of men trained in the ordinary dental sciences to take care of the public. With this plan the need for the dental mechanics would disappear. If there is a continued attempt on the part of many men to raise requirements for a dental education so high as to prevent a sufficient number's being trained to take care of the public, the dental mechanic will increase in numbers and be the same detriment to the profession that the osteopath and chiropractic are to the medical profession.

The only way to permanently curb the activities of the dental mechanic is to change the plan of dental education so as to eliminate them and raise

the standard of the dental profession by postgraduate instructions rather than by a "process of elimination" as some are advocating. More dentists to serve the public and postgraduate instructions to raise the standards of the profession will satisfactorily solve the dental mechanic problem, and nothing else will do it.

Southwestern Society of Orthodontists

THE Third Annual Session of the Southwestern Society of Orthodontists was held in San Antonio, Texas, January 17 to 20, inclusive. The meeting was the most successful to date. The clinics and papers by members were very good, instructive and practical. The course in Lingual Appliances, given by Dr. Owen A. Oliver, of Nashville, Tenn., was very instructive, being practical, and as some 75 cases were shown both during and after treatment with appliances used, together with several forms of appliances of Dr. John V. Mershon, real worth while instruction was obtained. In addition Dr. Oliver gave excellent clinics of his methods of band technic and appliance construction.

The first day's session opened with President W. E. Flesher, Oklahoma City, presiding. A welcome address by Dr. S. B. Riggs, of San Antonio, who, besides giving us a hearty welcome, gave a very interesting account of the early history of San Antonio. A response by Dr. T. W. Sorrels, Oklahoma City, was followed by the President's address by Dr. W. E. Flesher, Oklahoma City. Dr. Oliver gave an outline of his proposed course following with a paper, "Certain Limitations of Appliances Used in Orthodontia."

The afternoon was devoted to that most universal game, namely, golf, at the Alamo Country Club. Dr. Oliver turned in the lowest medal score, 89, and is the proud possesser of the cup presented by C. V. Mosby Company, St. Louis, Mo.

Second prize, a leather golf bag, presented by the Quillian Co., San Antonio, was won by Dr. P. G. Spencer, Waco, with a 90. Third prize, a set of Child's extracting forceps was won by Dr. O. E. Busby, Dallas, with a 155, "highest score." Dr. Busby deserves a vast amount of praise. He has set a high mark for other members to shoot at and his scientific use of the mashie cannot be described, while his short game and putting were nearly perfect. When receiving congratulations he modestly stated that he did not bother to count the strokes when he failed to hit the ball.

Thursday, 9 A. M. Appliance Construction by Dr. Oliver. Paper—Chronic Mouth Breathing by Dr. L. K. Beck, M.D., San Antonio, presented at Thursday Luncheon.

2 P. M. Clinics.

A Simple and Accurate Method of Constructing Lingual Appliances, by Dr. Edmund Arnold, Houston, Texas.

A Practical Form of Bracket Attachment to Labial Arches, by Dr. O. E. Busby, Dallas, Texas.

A Simple Method of Replacing Missing Anterior Teeth During the Period of Treatment and Retention, by Dr. P. G. Spencer, Waco, Tex.

Reducing and Splinting Fractures by Means of the Bracket Band and Ribbon Arch, by Dr. T. O. Gorman, San Antonio.

A New Method of Wiring Fractures of Mandible, by Dr. T. W. Sorrels, Oklahoma City, Okla.

An Appliance for Expansion Where Extreme Overbite Prevents Use of Lingual Appliances, by Dr. Wm. T. Chapman, El Paso, Texas.

Treatment of a Bilateral Distoclusion Case, Using Soldered Lingual and High Labial Appliances, Dr. W. E. Flesher, Oklahoma City, Okla.

Maxilla Development from Orthopedic Stimulation, Dr. T. M. Robertson, Coffeyville, Kansas.

Aderer Clutch Lock Used with Angle Ribbon Arch, by Dr. E. E. Moore, Fort Worth, Texas.

Photographic record of cases. By Dr. Wm. B. Stevenson, Amarillo.

7 P. M. Dinner, Alamo Country Club. The winning team were guests of the losing team of the golf tournament.

Friday, 9 A. M. Orthodontic Treatment with Lingual Appliances on Models, before and after Treatments, by Dr. Oliver.

5 P. M. Papers, "Some Phases of Distoclusion," by Dr. T. G. Duckworth, San Antonio, Texas. "Services and Compensation," by Dr. Hugh G. Tanzey, Kansas City, Mo.

6 P. M. Mexican dinner as guests of Drs. Duckworth and Gorman.

8 P. M. Business Session. Officers elected for 1923, President, Dr. T. G. Duckworth, San Antonio, Pres.-Elect, Dr. T. W. Sorrels, Oklahoma City, Okla., Secretary-Treasurer, Dr. P. G. Spencer, Waco, Texas.

Three year Term Board of Censors, Dr. O. H. McCarty, Tulsa, Okla. New Members elected; Drs. E. A. Morris, E. F. Woodring, C. W. Williams, J. M. Murphy, N. H. Coleman, C. H. McCarty, H. A. Potter, Sidney S. Block, Roy Woolfe, L. M. James, Wm. A. McCarter, Maj. L. C. Fairbanks, Geo. A. Hally, H. A. Allshouse. Drs. Oren A. Oliver and Wm. J. Brady were elected as honorary members.

Saturday, 9 A. M. Wire pinching technic, by Dr. Oliver.

10 A. M. Auto Ride over city, visiting all parts of historic interest in and about San Antonio.

2 P. M. Attendance midwinter session of San Antonio Dental Society.

7 P. M. Banquet, Gunter Hotel, as guests of the San Antonio Dental Society.

The following were in attendance: Drs. O. A. Oliver, Nashville, Tenn. J. O. Gorman, San Antonio, Tex. T. G. Duckworth, San Antonio, Tex. Edmund Arnold, Houston, Tex. A. E. Morris, Galveston, Tex. H. Wiggins, San Angelo, Tex. W. H. Chapman, El Paso, Tex. Wm. B. Stevenson, Amarillo. E. E. Moore, Fort Worth, Tex. N. H. Coleman, Wichita Falls, Tex. J. W. Murphy, Temple, Tex. H. H. Kaho, Claremore, Okla. W. E. Flesher, Oklahoma City, Okla. T. W. Sorrels, Oklahoma City, Okla. O. E. Busby, Dallas, Tex. A. B. Conley, Dallas, Texas. O. H. McCarty, Tulsa, Okla. E. F. Woodring, Tulsa, Okla. T. M. Robertson, Coffeyville, Kansas. Hugh G. Tanzey, Kansas City, Mo. Harry Holder, Nashville, Tenn. P. G. Spencer, Waco, Texas.

Waco, the Wonder City of Texas, was unanimously selected for the fourth Annual Meeting; plans are already being made to excel if possible the meeting just held.—P. G. Spencer, Secretary.

ORTHODONTIC NEWS AND NOTES

Bi-Centenary of Pierre Fauchard

This year marks the two hundredth anniversary of the completion of the writing of Fauchard's "Le Chirurgien Dentiste." The First District Dental Society and the Dental Society of the State of New York has seen fitting to commemorate this event, by an exhibit during the State Meeting of early dental literature and other historical material. Thursday evening, May 10, will be devoted to a series of addresses by Dr. J. J. Walsh, "Medicine and Dentistry," Dr. Herman Prinz, "Fauchard and His Works," and "Influence of Fauchard on Dentistry."

The above Societies extend an invitation to all members of the profession to be present.—B. W. Weinberger, Chairman.

The American Society of Dental Radiographers

The third annual meeting of the American Society of Dental Radiographers will be held at the Hotel Statler, Cleveland, on Friday and Saturday, September 7 and 8. An interesting scientific program has been prepared.

All members of the American Dental Association interested in the science of Dental Radiography are very cordially invited to attend. James H. Prothero, President, Marshall Field Bldg., Chicago, Ill. Martin Dewey, Secretary, 501 Fifth Ave., New York, N. Y.

Notes of Interest

Dr. G. W. Kauffman announces the removal of his office from Iowa Bank Bldg., to 314 Iowa Bldg., Des Moines, Iowa.

Dr. Joseph D. Osborn announces the removal of his office from 829 Healey Bldg., to Candler Bldg., Atlanta, Ga.

Dr. Yoakum announces the removal of his office from The Burlington to 305-307 Medical Science Bldg., Washington, D. C.

Dr. J. L. Minor announces the removal of his office from Ruthven, Iowa, to 205-206 Carver Bldg., Fort Dodge, Iowa.

Dr. C. C. Hugan announces the removal of his office from 300 S. Saginaw St., Flint, Michigan, to 19104 Woodward Ave., Detroit, Mich.